TECHNISCHE UNIVERSITÄT
ILMENAU

Current Challenges in Digital Communication Research: Data Science in Digital Media

SS2024

Course Instructors: Prof. Dr. Emese Domahidi, Prof. Dr. Kai-Uwe Sattler & Ngozichukwuka Onah

Topic 1: Communication of Sustainability of Universities (YouTube Channels)

Research Questions

I. "*How do University institutions utilize their official social media channels (YouTube) to communicate environmental sustainability efforts to the general public?*" and

II. *"How does the online community respond to environmental sustainability efforts and initiatives by different universities?*

Group Participants (01)

S/N	Name	ID Number	Tasks Division
1.	Shawal Ibrahim Khan	63725	- Entire Technical Part - Coding - Graphs Representations - Methodology - Results
2.	Vera Yeboah	65618	- Data Collection - Literature review - Sentimental analysis - Ethical Review
3.	Anass Elhoussni	65910	- Literature review: gaps in sustainability communication and the derivation of the research questions from the literature. - Methodology description - Sentimental analysis - Data collection
4.	Baraka Basil Anania	65669	- Data Collection - Introduction - Sentimental analysis - Discussion & Outlook

(Submission)

31.08.2024

Table of Contents

1.0 Introduction

Sustainability as defined by the United Nations' Sustainable Development Goals (SDGs), aims to balance social, economic and environmental needs to ensure a prosperous future for all. These 17 interconnected goals address global challenges such as poverty, inequality, climate change and environmental degradations, emphasizing the immediate necessity of holistic and inclusive approaches to development (United Nations, 2015)**.**

Environmental sustainability on the other hand, is a key component of the SDGs, focusing on protecting natural resources and ecosystems to support life on earth. It comprises SDG 13 (Climate Action), SDG 14 (Life Below Water) and SGD 15 (Life on Land), which aim to combat climate change, preserve marine environments, and support terrestrial ecosystems (United Nations, 2015). As institutions of higher learning, universities have a responsibility to lead in environmental stewardship and educate on sustainable practices by utilizing their digital platforms through raising awareness, influencing behavior and fostering a culture of sustainability both on and off-campus. Once these digital platforms are effectively utilized, universities can reach a broader audience, share real-time updates and engage stakeholders in meaningful ways (Leal Filho & Bard, 200 p. 210) .

As the effects of climate change and environmental degradation have become a reality, university institutions play a vital role in implementing sustainability initiatives. While there is a lot these institutions can do, efforts to reduce carbon footprints, manage waste, conserve energy, ensure greener campuses, and incorporate sustainability into curricula and research are among the actions that can be implemented. They can influence public awareness and emphasize behavioral change through effective digital communication, addressing climate issues and promoting necessary mitigation steps.

Furthermore, the most recent climate change discussions at the 28th Conference of the Parties (COP28) to the United Nations Framework Convention on Climate Change (UNFCCC), held from November 30 to December 12, 2023 in Dubai, where global leaders highlighted climate concerns highlighting immediate actions to protect our planet as a role of every individual (UNFCCC, 2023.p45).

Despite the growing emphasis on environmental sustainability, there is a gap in understanding "where" and "how" effectively these sustainability communication efforts reach and impact the general public. More importantly, the role of educational institutions, such as universities, is yet to be fully explored. Previous research often focused on corporate sustainability

communication, leaving university efforts less explored (Jones et al., 2017; Smith & White, 2020). This paper intends to fill this gap by exploring and optimizing these communication platforms (YouTube) to protect our planet for both current and for future generations.

Communication of these efforts by university institutions is equally important as it raises awareness, educates the community and inspires behavioral change to their audiences and readers. That is why this paper examines how universities utilize their official digital platforms, such as YouTube channels to communicate their environmental sustainability initiatives and the impact of these communications (reactions) on their stakeholders and the wider community at large.

Specifically, this paper intends to answer two important research questions; (i) "*How do University institutions utilize their official social media channels (YouTube) to communicate environmental sustainability efforts to the general public?*" and *"How does the online community respond to environmental sustainability efforts and initiatives by different universities?* The relevance of these questions is underscored by the urgent need to protect our planet where we all live, a role played by every human being under the earth.

The chosen method for this paper involved a quantitative approach. We collected data from the official YouTube channels of 10 English-speaking universities[1], simply based on their extensive online information on environmental sustainability initiatives. The paper employed Python and YouTube API to conduct a content analysis of their official YouTube channels (videos) to evaluate communication initiatives - and sentimental analysis, to explore engagement metrics of each university through comments.

2. 0 Literature review & Research question

2.1 Universities and Digital Platforms in Sustainability

Universities are pivotal in advancing environmental sustainability through research, teaching, and community engagement (Di Tullio, La Torre, & Rea, 2021). By integrating sustainability into their operations and outreach, they serve as catalysts for raising awareness and addressing global challenges (Leal Filho et al., 2018; Miotto et al., 2018). Additionally, universities influence public policy and improve quality of life, through their "third mission" (Miotto et al.,

[1] List of 8 Universities; University of Stanford, University of Manchester, University of Berkeley, University of Malborne, University of Toronto, Cornell University, University of Washington and University of Adeleide

2018; Cortese, 2003), while conducting research to find innovative solutions to pressing environmental issues.

Digital platforms have transformed how universities engage with the public on sustainability. The Internet and social media enable universities to connect with diverse stakeholders, effectively disseminating information and encouraging community participation (McAllister-Spooner, 2009).

YouTube, in particular, offers a dynamic way to reach and engage broader audiences. Its visual format is ideal for sharing sustainability narratives through documentaries, research highlights, and expert interviews (Smith & Anderson, 2018). Beyond content dissemination, YouTube fosters interactive dialogues, making it a powerful tool for discussing complex sustainability topics (Kaplan & Haenlein, 2010; Dylko et al., 2012). However, the effectiveness of these efforts can vary due to cultural, economic, and regulatory factors, and responses to sustainability messages may be mixed, especially if perceived as "greenwashing" (Kemper et al., 2019).

2.2 Addressing gaps in sustainability communication research

Research on corporate sustainability communication emphasizes transparency, strategic messaging, and stakeholder engagement (Jones, Hillier, & Comfort, 2017; Dhanesh, 2022). However, there is limited research on how universities communicate their sustainability initiatives, despite their crucial role as educators and sustainability advocates (Bizerril, 2018; Kaur & Chahal, 2018). While digital platforms are recognized as influential in shaping societal views and promoting sustainable practices, empirical evidence of their effectiveness in academic settings is lacking (Alcántara-Rubio, González-Moreno, & Triguero, 2022).

2.3 Research questions and their derivation from the literature

Given these gaps, this study seeks to address the following research questions, which have been derived from identified gaps in the existing literature. The first question examines how different university institutions utilize their YouTube channels to communicate their environmental sustainability efforts to the public. This question arises from the current understanding that, while YouTube is recognized as a powerful tool for audience engagement, there remains limited knowledge of the specific strategies and content types employed by universities. Although some best practices have been identified, a more detailed analysis is necessary to capture the diversity of approaches across various institutions.

The second question explores how the online community responds to environmental sustainability efforts and initiatives by these universities. Previous studies have highlighted varying levels of audience engagement with sustainability content on YouTube, revealing that people often hesitate to interact, comment, or engage with environmental sustainability videos. This question aims to address these issues by investigating the effectiveness of university communications and identifying the factors that influence audience engagement.

According to previous studies, research indicates that universities find social media platforms invaluable for promoting their sustainability initiatives, primarily through engagement metrics such as views, likes, comments and shares. For instance, (Carpenter et al., 2016) found that leading universities in the USA and South Korea, use social media such as YouTube and Facebook to engage and inform their audience on sustainability topics due to their flexible communication nature, which engage likes/dislikes, comments and views. Real time dialogues and feedback, comments and music, underscores the usage of social media platforms such as YouTube and Facebook for communicating their sustainability initiatives.

2.4 Theoretical Framework

To analyze and understand the phenomenon of media consumption, particularly in the context of universities leveraging social media platforms, Media Richness Theory (MRT) offers valuable insight. Developed by Daft and Lengel (1986), the theory focuses on the process and richness of the media used. YouTube's video format is considered a rich medium as it combines various elements such as visuals, spoken explanations, text, and music, thereby enhancing the clarity of messages and engaging the audience.

In the context of University institutions utilizing YouTube channels in their environmental sustainability initiatives communication, the platform is preferred due to the fact that apart from having elements such as visual and auditory nature, live videos, text and music altogether, it also provides a room for views, comment section and like/dislike features thus enabling prompt audience feedback, facilitating two-way communication and minimizing uncertainties - which aligns with the principles of MRT.

3.0 Methods

3.1 Data Collection and Sample

The study's dataset comprises engagement metrics from five universities, focusing on environmental sustainability topics. The metrics include total likes, comments, views, and the

number of videos from January 1, 2020, to June 30, 2024. Specific keywords related to environmental sustainability were used to filter and gather relevant data, ensuring the dataset's relevance to the topic. The universities and their respective metrics are:

Universities	Total likes	Total comments	Total views	Number of videos
University of Melbourne	231	9	51585	25
University of Berkeley	82	2	6043	7
University of Stanford	490	44	118913	33
University of Manchester	48	0	4871	27
University of Washington	17	1	842	12
University of Adelaide	52	4	4473	5
University of Cornell	261	44	15394	7
University of Toronto	130	3	89424	8

These metrics were collected for the entire specified period for each university to provide a comprehensive view of user engagement.

3.2 Analysis Method

The primary analysis focuses on quantitative measures of engagement—likes, comments, views, and the number of videos. This method provides a straightforward numerical representation of user engagement across different universities. The total likes, comments, views, and video counts for each university were aggregated and visualized using a grouped bar chart with dual y-axes.

For data manipulation and analysis, Pandas was used for efficient handling of Data Frames. Visualizations were created using Matplotlib and Matplotlib. Dates, while Seaborn was used to enhance these visualizations with more attractive and informative statistical graphics.

Numerical operations and array handling were managed using NumPy, and the Google API Client facilitated the access and collection of YouTube data.

To gain deeper insights into audience reactions to universities initiatives in environmental sustainability, we undertook a comprehensive sentiment analysis. This process involved meticulously examining each comment on the university's videos posted on the YouTube channels of universities. By categorizing these comments into positive, negative, and neutral sentiments, we were able to gauge public perception more accurately. sustainability initiatives.

3.3 Validation

Validation is implied through the accurate aggregation of engagement metrics for each university. The reliability of the analysis depends on the correctness of this data aggregation process. However, specific validation techniques, such as manual verification of the data, are n

3.4 Limitations and Potential Sources of Bias

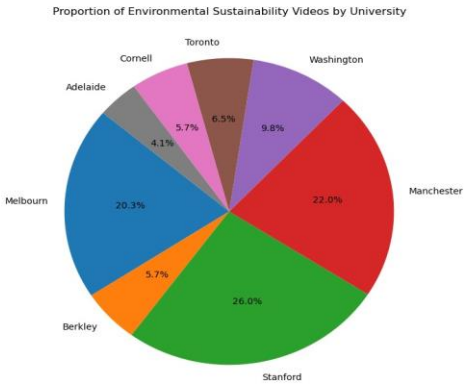
The period of data collection (January 1, 2020, to June 30, 2024) may affect the representativeness of the results. This period includes significant global events such as the COVID-19 pandemic, which could influence user engagement metrics. The analysis assumes the data from each university is comprehensive and accurate. A significant limitation is the exclusive reliance on quantitative metrics, which may overlook qualitative aspects of user engagement, such as the sentiment behind comments or the content quality of videos.

4. 0 Results

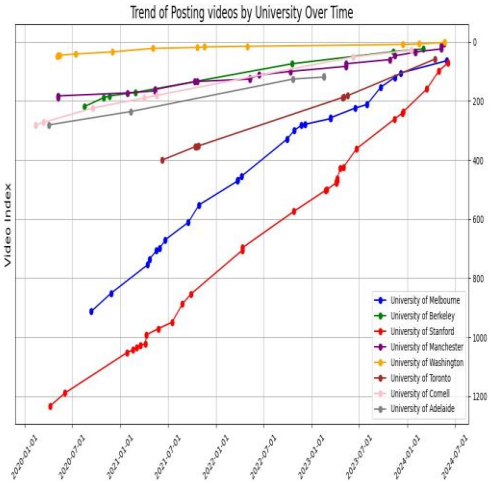
This section presents the results obtained as per the research questions; (i) How do different university institutions utilize their official social media platforms (YouTube) to communicate their environmental sustainability efforts to the general public? and (ii) How does the online community respond to environmental sustainability efforts and initiatives by different universities? The results focus on environmental sustainability content by eight (8) universities through their official YouTube channels. A comparison was done, presenting consistency of environmental sustainability videos by universities, number of videos uploaded per university, frequency/trend and engagement matrix of the online community through views, likes and comments. The analysis focused on environmental sustainability-related content from 01.012020 to 30.06.2024.

4.1 Volume and Frequency intervals/trends

The number/volume of environmental sustainability-related videos posted by universities on their YouTube channels varies significantly. Some universities present many environmental initiatives contents updated on their channels, ensuring their audience is updated overtime. In contrast, some universities have very few environmental sustainability contents on their sustainability YouTube channels.



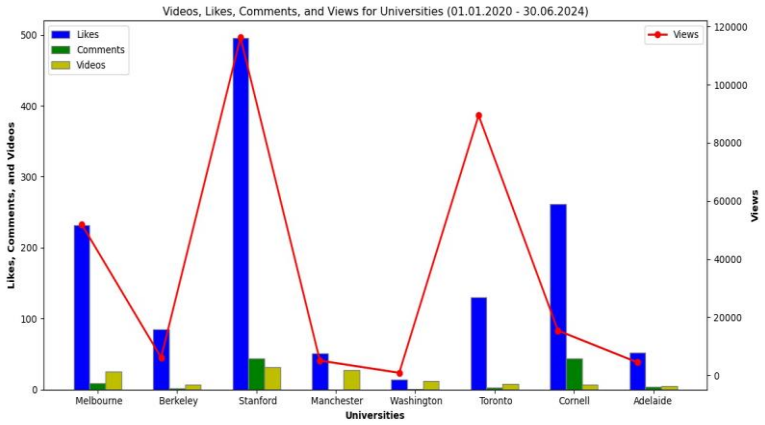
[fig1] shows how the Universities updated their YouTube sustainability with environmental sustainability contents, in the period from January 2020 to June 2024. The results show the University of Stanford to have many videos updated with 32 videos (26%) - implying high volume in updating their channel, followed by the University of Manchester, with 27 videos (22%). In contrast, the University of Adelaide had only 5 videos (4%) followed by the University of Cornell and Berkeley, both with 7 videos (5.7%) - meaning low volumes. On the other hand, trends in updating the universities' sustainability channels with environmental sustainability contents differ from one university to the other. some universities update their YouTube channels more frequently whereas some universities update their channels far less frequently. For instance, [*Fig2.]* shows how frequently 8 Universities updated their official YouTube channels with environmental sustainability initiatives from January 2020 to June 2024.



According to the graph, University of Stanford is leading in uploading environmental sustainability videos more frequently with the years with less interval between one content to the other followed by the University of Melbourne. On the contrary, University of University of Washington followed by the University of Berkley, presents low trends in uploading environmental sustainability videos to their YouTube channels.

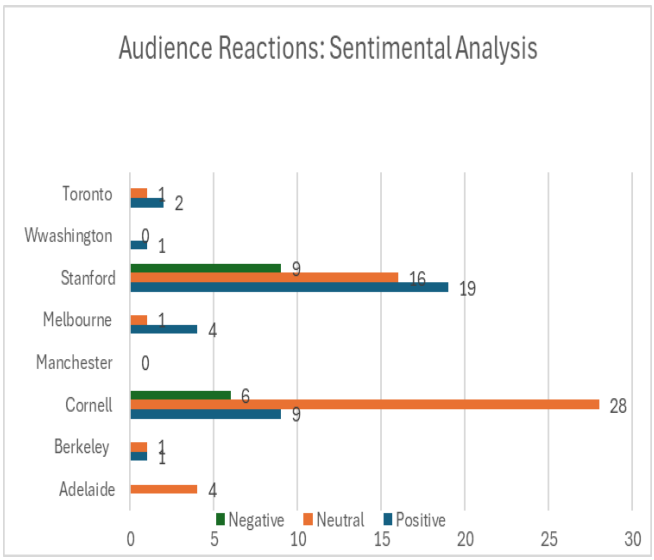
4.2 Audience Engagements and Interactions

This sub=section intends, mainly to show how the online community/audience responds to environmental sustainability videos uploaded by the 8 Universities from 2020 to 2024. Specifically, it shows how the online community follows up on the contents uploaded through Universities' sustainability channels through views, likes and comments. Similarly with the trends and volumes, audience engagement differs from one University to the other.



[Fig3], presents the difference in audience engagements through likes, views and comments among the universities. For example, the University of Stanford is constant in both number of videos posted, trends as well as the audience engagements. The University presents a total of 490 likes, 44 comments, 33 number of videos uploaded and 51585 total views. On the other hand, the University of Adelaide shows a very low audience engagement/responses with a total of 52 likes, 4 comments, 4473 views and 5 videos uploaded from January 2020 to June 2024.

Furthermore, the results show a sentimental analysis exploring the audience reactions through comments, typically showing how the audience responds to the contents uploaded on the YouTube channels. The engagement matrix through sentimental analysis shows positive, neutral and positive comments from the online community.



According to *[Fig4]*, the University of Stanford demonstrates a high level of audience interaction through comments compared to other universities. By June 2024, the University had received a total of 44 comments on all its environmental sustainability videos. Of these, 19 were positive, 16 were negative, and 9 were neutral.

The positive feedback included enthusiastic praise such *as "Great presentation!!! Biophilic design rocks and is proven to make lives better!! Congrats!"*. These comments reflect a strong appreciation for the content and a willingness to engage further with related ideas.

However, the negative feedback was equally expressive, with one commenter harshly criticizing the content by stating, "*Wow... That's quite possibly the STUPIDEST THING I HAVE EVER HEARD..."* This strong reaction underscores the polarized views that environmental sustainability initiatives can evoke, highlighting the challenges universities face in communicating these topics effectively.

5. 0 Discussion and Outlook

5.1 Brief Summary of Results and interpretation

The study intended to answer two important questions, on how different Universities ; How do university institutions utilize their social media platforms (YouTube channels) to communicate their environmental sustainability initiatives to the general public and also, how the online community responds to the contents uploaded. The analysis of data showed significant insights into the communication of environmental sustainability initiatives among these institutions – with the University of Stanford leading on environmental sustainability contents.

Looking at how the audience/public responds to these initiatives, the data indicated “views” to be the most common form of interaction followed by “likes”. On the other hand, “comments” were least indicated. This might indicate that, even though the content is being viewed, it might not capture viewers’ attention. This trend/observation was consistent in all universities, indicating a potential area for improving interactive communication.

5.2 Explanation of Results for Theory and Practice

The results of our study demonstrates how universities utilize their YouTube channels to communicate their environmental sustainability initiatives and how the general public responds to the contents being uploaded, aligning well with the Media Richness Theory (MRT). University of Stanford for instance, leverage YouTube’s rich media capabilities such as videos, audios, live streaming, music and interactive features such as likes/dislikes, views and comments to communicate their environmental sustainability initiatives, The theory suggests that the richer the communication media platform (in this context, YouTube channels) is, the higher the possibilities and effectiveness of the media platform usage, which is reflected in our findings.

The findings support previous research by (Khan, Saeed, Anwar & Kanwal, 2023) which emphasizes on how social media platforms such as YouTube channels are being utilized for communication purposes in educational settings. The observed differences in likes/dislikes and comments across universities' YouTube channels align with MRT's observation. By using YouTube channels, it is proved that universities are able to communicate their environmental sustainability initiatives more effectively and engage with their audiences in meaningful ways.

5.3 Limitations and Future Research Recommendation

While the study provided valuable insights on how universities utilize their official YouTube channels to communicate their environmental sustainability efforts to the general public, it has a number of limitations. Firstly, the study was restricted to English-speaking universities, overlooking other non-English speaking institutions. Future research could consider diversification of universities from different languages, also taking into consideration both low and high ranked institutions.

Similarly, the study employed a sample size of five universities and time from 2020 to 2024, which is subject to limitations. This sample might not be representative of broader trends in universities' environmental sustainability communications. A larger sample size and a longer time frame could provide more robust and generalizable findings. On the other hand, a relatively short time may not capture the long-term environmental sustainability initiatives in full and relative to changing environmental and social dynamics. Future studies should consider expanding both the sample size and duration to enhance the validity and reliability of findings.

Additionally, the study relied on YouTube as the only digital platform for data collection. While YouTube is a major platform for video contents, other social media platforms such as Twitter, Facebook and Instagram play a crucial role in sustainability communication. While understanding the impossibilities in accessing the Application Programming Interface (APIs) for the mentioned platforms for data analysis purposes, these social media platforms have gained major attention from people all over the world in recent years, and many institutions (including universities) utilize them to communicate different initiatives. Ignoring other platforms, leaves behind the usefulness of other social media platforms such as Facebook, Instagram and Twitter. Future research could consider a design which includes multiple platforms in the study to get even more generalized results.

6.0 References

Alcántara-Rubio, L., Valderrama-Hernández, R., Solís-Espallargas, C., & Ruiz-Morales, J. (2022). The implementation of the SDGs in universities: A systematic review. *Environmental Education Research, 28*(11), 1585-1615.

Bizerril, M., Rosa, M. J., Carvalho, T., & Pedrosa, J. (2018). Sustainability in higher education: A review of contributions from Portuguese speaking countries. *Journal of Cleaner Production, 171*, 600-612.

Borg, S., & Young, R. (2020). Study on the potential of YouTube as a tool for engaging audiences on sustainability issues. *Journal/Publisher details.*

Boud, D. (2000). Sustainable assessment: Rethinking assessment for the learning society. *Studies in Continuing Education, 22*(2), 151-167.

Brunsting, S., & Postmes, T. (2002). Social movement participation in the digital age: Predicting offline and online collective action. *Small Group Research, 33*(5), 525-554.

Cho, M., Jung, J., & Park, H. (2020). Social media use for sustainability communication in higher education: A comparative analysis of leading universities in the USA and South Korea. *Journal of Higher Education Policy and Management, 42*(1), 5-22.

Cortese, A. D. (2003). The critical role of higher education in creating a sustainable future. *Planning for Higher Education, 31*(3), 15-22.

Dhanesh, G. S. (2022). Corporate responsibility and strategic communication. In *Research Handbook on Strategic Communication* (pp. 319-334). Edward Elgar Publishing.

Di Tullio, P., La Torre, M., & Rea, M. A. (2021). Universities and the sustainable development goals (SDGs): The impact of university activities on society. *Sustainability, 13*(21), 11796.

Dylko, I. B., Beam, M. A., Landreville, K. D., & Geidner, N. W. (2012). Political communication and engagement on YouTube. *Journal/Publisher details.*

Etter, M., Ravasi, D., & Colleoni, E. (2019). Social media and the formation of organizational reputation. *Academy of Management Review, 44*(1), 28-52.

Filho, W. L., Shiel, C., & Paço, A. (2015). Integrative approaches to environmental sustainability at universities: An overview of challenges and priorities. *Journal of Integrative Environmental Sciences, 12*(1), 1-14.

Fonseca, A., Macdonald, A., Dandy, E., & Valenti, P. (2011). The state of sustainability reporting at Canadian universities. *International Journal of Sustainability in Higher Education, 12*(1), 22-40.

Jones, P., Comfort, D., & Hillier, D. (2005). Corporate social responsibility and the UK's top ten retailers. *International Journal of Retail & Distribution Management, 33*(12), 882-892.

Jones, P., Hillier, D., & Comfort, D. (2017). Sustainability in the global hotel industry. *International Journal of Contemporary Hospitality Management, 29*(1), 3-17.

Kaplan, A. M., & Haenlein, M. (2010). Users of the world, unite! The challenges and opportunities of social media. *Business Horizons, 53*(1), 59-68.

Kaur, A., & Chahal, H. S. (2018). Role of social media in increasing environmental issue awareness. *Researchers World, 9*(1), 19-27.

Kemper, J. A., Ballantine, P. W., & Hall, C. M. (2019). The effectiveness of social media messages in promoting sustainability: Engagement and skepticism. *Journal/Publisher details.*

Leal Filho, W., & Bardi, U. (2020). Sustainability on university campuses: Learning, skills building and best practices. *Springer.*

Leal Filho, W., Shiel, C., & Paço, A. (2019). Sustainable development goals and sustainability teaching at universities: Falling behind or getting ahead of the pack? *Journal of Cleaner Production, 232,* 285-294.

Leal Filho, W., Shiel, C., Paço, A., Mifsud, M., Veiga Ávila, L., & Brandli, L. L. (2018). The role of planning in implementing sustainable development in a higher education context. *Journal of Cleaner Production, 199,* 59-64.

Leal Filho, W., Vargas, V. R., Salvia, A. L., Brandli, L. L., Pallant, E., Klavins, M., ... & Vaccari, M. (2019). The role of higher education institutions in sustainability initiatives at the local level. *Journal of Cleaner Production, 233,* 1004-1015.

Lozano, R., Lukman, R., Lozano, F. J., Huisingh, D., & Lambrechts, W. (2013). Declarations for sustainability in higher education: Becoming better leaders, through addressing the university system. *Journal of Cleaner Production, 48,* 10-19.

McAllister-Spooner, S. M. (2009). Fulfilling the dialogic promise: A ten-year reflective survey on dialogic internet principles. *Public Relations Review, 35*(3), 320-322.

Miotto, G., Del-Castillo-Feito, C., & Blanco-González, A. (2018). Reputation and legitimacy: Key factors for higher education institutions' sustained competitive advantage. *Journal of Business Research, 89,* 362-370.

Mochizuki, Y., & Fadeeva, Z. (2010). Competences for sustainable development and sustainability: Significance and challenges for ESD. *International Journal of Sustainability in Higher Education, 11*(4), 391-403.

Salvioni, D. M., Franzoni, S., & Cassano, R. (2017). Sustainability in the higher education system: An opportunity to improve quality and image. *Journal of Management and Governance, 21*(4), 853-885.

Smith, A., & Anderson, M. (2018). Social media use in 2018. *Pew Research Center.*

United Nations. (2015). Transforming our world: The 2030 agenda for sustainable development. *United Nations General Assembly.*

United Nations Framework Convention on Climate Change. (2023). *COP28UAE.*

Velazquez, L., Munguia, N., Platt, A., & Taddei, J. (2006). Sustainable university: What can be the matter? *Journal of Cleaner Production, 14*(9-11), 810-819.

7. Additional materials as extra files

The additional files are submitted separately and includes (i) Python Script, (ii) Data management, (iii) Sentimental Analysis through comments, and (iv) ethical review.