



Article A Longitudinal Analysis of the Creation of Environmental Identity and Attitudes towards Energy Sustainability Using the Framework of Identity Theory and Big Data Analysis

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Abstract: Embracing sustainability in the 21st century entails developing environmental identity, so that attitudes towards energy sustainability result from the core values of one's individual and social identity. This study aims to explore the shift in the formation of environmental identity and attitudes towards energy sustainability throughout the course of the two-year study period (2018–2020). A dataset of 8,677,961 tweets, Facebook posts and comments and 325,228 news articles was collected to carry out quantitative analysis of the distribution of the posts, likes, and comments. A correlation with media coverage of energy and green topics was sought to establish the impact of the media on public debate. A qualitative analysis of posts and tweets was carried out to establish dominant themes. The findings of the study reveal that both positive attitudes towards energy sustainability and environmental identity have been consolidated throughout the two-year study period. Social media users are not only increasingly interested in green issues but also produce more reactions towards posts related to sustainability topics. The results also suggest that sustainable values and green behavior are independent from the media coverage of current events and the perceived threat to one's health from COVID-19. Social networking sites provide a context in which users not only reinforce their beliefs and values, but also mimic the behavior of other users, which leads to the formation of a social media identity bubble that reinforces shared identity—in this case, environmental identity. This study offers a multidisciplinary perspective on sustainable development that will be able to drive equitable energy security and environmental security.

Keywords: energy sustainability; environmental identity; sustainable values; social media mining; big data analytics; energy security

1. Introduction

The modern-day consumption patterns and rapid technological progress bring about increasing socio-environmental threats [1-4], whereas natural disasters lead to considerable risks being faced by energy systems [5]. The implementation and support of sustainable development is a key goal of both international organizations [6,7] and national governments [8,9]. Sustainability is not only a crucial component of national security and environmental integrity, but is also a strategic imperative for wider security [10]. The worldwide aim of promoting sustainability emphasizes the importance of balanced development [11] as well as respect for human rights, non-discrimination, and equity. Therefore, governments, organizations, communities, and individuals are prioritizing the values of intergenerational equity, respect for human rights and the environment. However, to ensure a long-term and permanent change, an individual needs to develop an environmental identity, so that attitudes towards energy sustainability result from the core values of one's individual and social identity. In the literature, the term environmental identity is used to refer to "a sense of connection to some parts of the non-human natural environment, based on history, emotional attachment, and/or similarity, that affects the way in which we perceive and act towards the world; a belief that the environment is important to us

and an important part of who we are" [12]. Since most environmental threats have been induced by human behavior, individual sustainable behavior needs to be promoted.

This paper offers a look at sustainability in the framework of identity theory in order to explore the shift in the formation of environmental identity throughout the course of the two-year study period (2018–2020). Social media mining techniques and statistical analysis were applied to environment-related posts to carry out a quantitative analysis of the data. The study aimed to answer the following research questions: (1) to what extent has environmental identity consolidated throughout the study period? (2) What is the correlation between green energy- and environment-related posts and media coverage of green issues? (3) What is the correlation between green energy- and environmentrelated posts and public reaction to the posts? The objective of the study was to test the following hypothesis: environmental identity has been consolidated throughout the two-year study period. No previous study has carried out a longitudinal analysis of green energy- and environment-related posts and Twitter. The present study is, therefore, the first to use big data to examine the development of the environmental identity of social media users.

2. Theoretical Framework of Identity Research

2.1. Personal Identity

Personal identity (which may be defined as "individuals' subjective feelings about the combination of personality characteristics which distinguish them from others, providing them with a sense of uniqueness" [13]) is the outcome of the process of interactions with other people, social category acquisition, and appropriate behavior. The concept of identity differs from the concept of the self (also due to its complex nature, referred to as the self-system), which can be defined as "the multifaceted theory that all individuals construct in the course of development as to who they are and how they fit into society, based on a sense of continuing identity at the core of one's awareness" [13]. Thus, identity is a wider term, based on the self, shaped by one's personal experience and producing a feeling of cohesion and stability.

The concept of identity was examined by various researchers who attempted to describe and identify it. G. H. Mead [14] argued that the self is composed of Me, a social component, and I, a psychical component. Me is the individual's conception of how other people perceive him or her and of others' expectations of the individual's behavior as well as social norms and laws, whereas I is the individual's spontaneous and impulsive response to others' attitudes. Both G. H. Mead [14] and W. James [15] claimed that it is due to identity that human behavior is coherent and logical; identity also functions as a point of reference that people refer to and evaluate.

J. E. Marcia [16] constructed a model of identity development using two organizing principles: crisis (i.e., the time of decision-making when various options are examined) and commitment (i.e., taking decisions and deciding on a self-definition) which, in combination, produce four identity statuses: foreclosure (refers to those who have made commitments without exploration), diffusion (describes those who are not examining and have no commitments), moratorium (illustrates those who are exploring at present but do not have any commitments), and identity achievement (refers to those who have questioned their identity and have made their commitments). The importance of Marcia's model lies in the fact that it presents a hierarchical order of maturity with identity achievement being the most mature status and foreclosure and diffusion being at the opposite end of the continuum, although some people with identity achievement status may return to a moratorium status for further exploration of their needs, values and of what is important for them. Finally, Marcia defined five central fields of identity: vocational choice, religious beliefs, political ideology, gender-role attitudes, and beliefs about sexual expression.

On the whole, identity is the outcome of self-experience, a dynamic process that is affected by both the external environment (socio-cultural requirements) and the individual's personality. It is formed through social interaction in the clash of personal needs, social demands, and action competences (through imitation and identification processes, often in a situation of conflict, distress or inconsistency). Through interactions with others, individuals attempt to identify themselves, their needs, their expectations, who they are as a separate entity and as a member of their peer group, family, church and other social groups. Like the socialization process, the process of identity formation is influenced by other contexts, e.g., political, economic system, historical time, and culture.

Integrated personal identity forms the basis for one's gender, ethnic, cultural, and national identity. Furthermore, consolidated identity allows people to act consistently according to their conscience regardless of the changes taking place in the modern world. Rapid technological advances as well as economic, political, and cultural transformations mean that society is no longer stable, nor does it provide support for individuals. Integrated identity helps the individual to face the ongoing transformations without constant changes of self-image because a clear identity structure does not yield to inner changes or changes of social milieu. What is important and valuable for individuals helps them to define themselves, especially in difficult situations of threat, decision-making, defining future goals, expectations and requirements.

2.2. Social Identity

Personal identity helps the individual to feel unique and distinctive from other people. However, being social animals, individuals also feel the need to be the same as some people, as they want to belong to certain social groups. According to Henri Tajfel and John Turner's social identity theory, apart from having several personal selves, an individual has numerous social identities, which are "that part of an individual's self-concept that derives from his knowledge of his membership in a social group (or groups) together with the value and emotional significance attached to that membership" [17] on the basis of which people perceive themselves and others. First, people categorize themselves and others into various social groups, which helps them organize and handle the complexity of reality; social groups are not random but socially constructed by comparison and contrast with other groups as well as simplification or stereotyping. Second, people identify with certain groups, which become their in-groups, accept their social identities, and which may enhance their self-esteem. Belonging to a given social group also entails a certain mode of thinking and behaving. Finally, people compare their own groups with other groups, which provides the basis for favoritism of their in-group [18] but also for competition, stereotyping, and even discrimination of members of out-groups, as the alleged differences between the two groups are often amplified. Identification with a given social group forms a part of the individual's personal identity by the internalization of the stereotyped qualities of the in-group member. People belong to various social groups; they therefore have multiple social identities, each of which carry importance for the personal identity and each becomes more salient depending on the context.

2.3. Environmental Identity

Identity is not only constructed in relation to other people and relationships with various groups and contexts; it is also based on an individual's relationship with the environment [19,20]. Environmental identity is part of the individual's self-concept that is based on a belief that "the environment is important to us and an important part of who we are" [12]. It is embedded in being subject to nature and is a motivator of a wide range of pro-environmental behavior [21]. Furthermore, environmental identity is related to affective qualities linked to values associated with nature and environmental rights [22]. Finally, it is deeply rooted in the individual's worldviews about nature and society [23].

A large body of research proves that pro-environmental behavior is important to the individual's sense of self. Gatersleben, Murtagh, and Abrahamse [24] and Whitmarsh and O'Neill [25] found that values and identities are good predictors of certain 'green' behavior. Environmental identity, along with attitudes and subjective norms, mostly correlates with the intention to act in an environmentally friendly way, in particular with recycling, buying

Fair Trade, and avoiding flying on holiday. However, there is a weak correlation between environmental identity and car use for work or shopping [24]. Therefore, environmental identity becomes more salient for behaviors in which individuals are free to act, such as choosing consumer products or holiday transportation. In a situation when practical factors constrain their behavior, such as driving to work or shop, the perceived constraints will be more salient and the environmental identity will be less salient. However, learning new 'green' behavior and reinforcing former eco habits strengthens environmental identities [26].

Kashima, Paladino, and Margetts [23] proved that environmental identity is a multifaceted concept that includes mundane environmentalism, i.e., being eco-friendly in a given context, and environmental striving. The former entails being eco-friendly in a particular context, whereas the latter refers to a more personal facet of environmental identity intricately embedded in the worldviews about the nature and society. This aspect of environmental identity motivates a wide array of 'green' behaviors without an external incentive [27]. Finally, Hurth [28] argued that environmental identity may be negatively perceived, as it is stereotypically associated with rejecting consumerism and instead promoting an economical lifestyle and self-denial.

3. Literature Review

A large and growing body of research has investigated the use of big data to increase customer loyalty [29,30], improve the quality of healthcare [31–33], and monitor public concerns [34]. Much of the current literature on social media pays particular attention to the sustainability of smart cities [35,36] and social media-mediated disaster communication [37]. Other studies examined political polarization, ideology-driven political violence [38], and the use of social networking sites as political tools [39,40].

Although ample studies have been carried out to gauge public sentiment, few studies focus on the analysis of environmental attitudes and sustainability values. Based on their analysis of tweets with the hashtag #WorldEnvironmentDay, Reyes-Menendez, Saura and Alvarez-Alonso [41] identified the principal negative, positive, and neutral factors concerning sustainable development. The following negative public concerns have been detected: climate change, clean water and sanitation, life on land, responsible production, pollution and biodiversity, and sustainable cities and communities. Positive indicators include public health, clean energy and sustainability. The neutral factors include sustainable cities, development of sustainable resources, and promotion of a healthy lifestyle. Other studies have explored the potential of social networking sites in exerting pressure on hotels to implement sustainable tourism development [42]. Ekenga, McElwain, and Sprague [43] analyzed the use of social media to gauge public sentiment about environmental health issues and emerging community concerns, whereas Palomino et al. [44] investigated the public perception of environmental health hazards and public health issues. All in all, the research proves that social media is a useful platform for communicating on the topic of sustainable values.

4. Materials and Methods

Using social media mining software, Unamo, all Facebook and Twitter posts under the search terms related to energy sustainability and environment key words and hashtags were identified in three 5-month intervals over 2 years (from 1 August 2018 to 31 December 2018; from 1 June 2019 to 31 October 2019; and from 1 March 2020 to 31 July 2020). Selecting posts and tweets based on key words and hashtags allows the content related to environmental safety to be captured. The corpus included (1) posts and tweets with the key word or hashtag; (2) posts and tweets with a link to a web page, e.g., a news article whose title or URL contains the key word or hashtag; (3) reposts and retweets that contain the original message wherein the key word or hashtag appears either in the original message or the repost/retweet. The posts and tweets were counted as one even if they contained several key words or hashtags. Contributions that failed to mention energy sustainability or environment safety were excluded from the corpus. The data were archived for quantitative analysis. The search yielded 25,711,844 tweets and Facebook posts and 325,228 news articles and comments. Only Polish language tweets and posts were included. All publicly available data, including the full-text content; publication time; numbers of likes, shares and comments; user information, were collected. The study was carried out in adherence to Rivers and Lewis's [45] recommendations for the ethical use of big data analysis on social networking. No ethical approval was required as the Facebook and Twitter data are already in the public domain.

A social media analytic tool employing data mining algorithms in C# was used to pre-process and clean the data as well as to perform the analysis. First, the dataset had to be cleaned due to the presence of a large number of irrelevant posts and tweets that were marketing information using sustainability-related hashtags to promote a post or make political comments. Pre-processing involved tweet cleaning (removing irrelevant information, such as URLs, Twitter handles, and Facebook usernames), removing punctuation, stop words, and special characters. This was an important stage implemented to increase the value of the data. After pre-processing, the sample was reduced to 8,677,961 unique posts and tweets. Figure 1 shows the time distribution of posts and tweets for each week.



Figure 1. Time distribution of environment-related posts and news items.

Next, two different types of analysis were carried out. First, a quantitative analysis was performed to test the hypotheses. The mean and SD of the number of posts, likes and shares in each time period were calculated. The Kolmogorov–Smirnov test, Shapiro–Wilk tests, the Spearman correlation, and the linear regression were employed to examine the differences in public reactions (the number of likes, shares, and comments) to posts and to establish a correlation between the number of posts and the number of news items published on social media.

Finally, a qualitative analysis of posts and tweets was carried out to establish dominant themes. Content analysis provides an insight into public concern regarding green energy and environment-related issues. To enhance the accuracy of the analysis, the sample was limited to main mentions (comments on posts and tweets were excluded). We sampled 7107 tweets and posts published in 2018, 2019, and 2020 and analyzed them to assess the predominant themes, which were elaborated through thematic coding of each post or tweet by a human coder (the author). The themes were identified as they emerged during data analysis instead of following a pre-existing theoretical framework. Posts with multiple themes were categorized into more than one category.

5. Results

The time distribution of the Facebook and Twitter data (both environment-related posts and news items) is provided in Figure 1. The number of environment-related posts was steadily rising with two peaks taking place on 3–5 April 2020 and 22 April 2020 (the peaks were related to the media coverage of animal rights issues). The publication of environment-related news items, on the other hand, was more frequent in 2018 than in other time periods (see Table 1).

Time Span of the Data	FB and TT Green Energy- and Environment-Related Posts		Likes of Green Energy- and Environment-Related Posts		Comments of Green Energy- and Environment-Related Posts		Green Energy- and Environment-Related News Items	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
1 August 2018 to 31 December 2018 1 June 2019 to 31 October 2019 1 March 2020 to 31 July 2020	16,303 18,913 22,489	5742 4085 6344	35,254 61,512 76,205	12,845 16,939 24,697	8684 10,042 12,174	3785 2833 5328	1321 455 382	1243 254 114

Table 1. Descriptive statistics of environment-related posts and news items.

Table 1 clearly shows the scale of the increase in the number of posts, not only concerning green energy and environmental issues, but also likes and comments on sustainability-related posts. The number of likes doubled over the 2-year-period of analysis, whereas the number of published posts and comments increased by 37% and 40%, respectively (see Tables 2–5).

Table 2. Kolmogorov-Smirnov and Shapiro-Wilk test (posts, likes and comments).

Variable –	Kolmogorov-Smirnov Test			Shapiro-Wilk Test		
	Statistic	df	<i>p</i> -Value	Statistic	df	<i>p</i> -Value
posts	0.069	456	0.000	0.899	456	0.000
likes	0.405	456	0.000	0.675	456	0.000
comments	0.324	456	0.000	0.740	456	0.000

The Kolmogorov–Smirnov statistic takes a value between 0.069 and 0.324, whilst the Shapiro–Wilk statistic takes a value between 0.675 and 0.899. The Shapiro–Wilk test agrees with the Kolmogorov–Smirnov *p*-value < 0.05. These tests show that the sample distribution is non-normal. There is a high variation not only in the number of social media messages but also in user response. Some posts (e.g., timely messages related to the media coverage of animal rights issues, as displayed in Figure 1) garner greater user response. To validate the research hypothesis, a correlation between variables was observed. The Spearman's correlation coefficient shows a very strong correlation between posts, likes, and comments (see Table 3). Posts are positively and significantly correlated with greater user response (*p* < 0.001 for posts, likes and comments). Social media users are not only increasingly interested in green issues but also react more to posts related to sustainability topics.

Table 3. Spearman's rank correlation coefficient (posts, likes and comments).

Variable	Test	Posts	Likes	Comments
	correlation coefficient	1.000	0.751 **	0.793 **
posts	significance		0.000	0.000
	Ň	456	456	456
	correlation coefficient	0.751 **	1.000	0.927 **
likes	significance	0.000		0.000
	Ň	456	456	456
comments	correlation coefficient	0.793 **	0.927 **	1.000
	significance	0.000	0.000	
	Ň	456	456	456

** significant correlation at the level 0.01.

Correlation analysis was also carried out to evaluate the association between the number of posts and the density of news coverage of green topics (see Tables 4 and 5).

Variable –	Kolmogorov-Smirnov Test			Shapiro-Wilk Test		
	Statistic	df	<i>p</i> -Value	Statistic	df	<i>p</i> -Value
posts news items	0.488 0.465	455 455	0.000 0.000	0.027 0.036	455 455	$0.000 \\ 0.000$

Table 4. Kolmogorov-Smirnov and Shapiro-Wilk test (posts and news items).

Table 5. Spearman's rank correlation coefficient (posts and news items).

Variable	Test	Posts	News Items
posts	correlation coefficient	1.000	-0.091
	significance		0.051
	N	455	455
news items	correlation coefficient	-0.091	1.000
	significance	0.051	
	Ň	455	455

The correlation coefficient points to a very weak correlation that is not statistically significant between the two variables. The linear regression analysis also showed a weak correlation between the number of sustainability- and environment-related posts and the number of news items published in social media ($R^2 = 0.088$), which suggests that the public perception of environmental issues was weakly associated with environmental identity. This finding lends support to our hypothesis that sustainable values and green behavior are independent from the media coverage of current events. The density of online debate weakly correlates with the media coverage of green issues, which is further explained in the concluding discussion.

The thematic analysis of environment-related posts points to the dominant themes in the public debate. Five main themes have been identified:

- Renewable energy information and innovations concerning reducing energy waste;
- Animal rights, animal (mal)treatment;
- Pollution, in particular air pollution;
- Information about pro-environmental regulations and what national or foreign authorities and organizations do;
- Suggesting behavior or environmental policy detrimental to sustainable values.

Generally, the posts promote pro-environmental behavior and condemn behavior that is unsustainable.

6. Discussion

The growing public interest in sustainability issues is reflected by the increase in the number of green energy- and environment-related posts, likes, and comments that have been posted. The public debate on social media weakly correlates with the media coverage of green issues. Therefore, although the media generally affects the salience of topics on the public agenda [46], it does not take place in the case of environmentrelated issues. The density of the online debate is independent from the news coverage of environmental topics, which suggests a growing and steady interest in sustainability regardless of whether 'green topics' receive high media attention. This might be related to the fact that environmental identity is integrated into personal and social identity and it is no longer processed on the level of awareness. It is high-level parallel-distributed processing that integrates various self-related processes embedded at the level of cognition, emotions, motivation, and volition [47]. Integrated environmental identity resists the changes taking place in the social context. Even a crisis situation, such as the COVID-19 pandemic and national lockdown and the resultant fear, anger, and anxiety over the health and economic situation [34,48,49] has not resulted in a decrease in public interest in environmental issues. This finding is in line with other studies [23–25] that focused on the integrity of sustainable identity with 'green behavior'. However, further research is needed to show whether the difficult situation of threat related to the pandemic has affected the environmental identity structure.

On the other hand, the increase in the number of environment-related posts that has taken place independently of the coverage of green topics by the mainstream media may be explained by the fact that news-related items have become less variable; for example, in the fall and spring, media coverage focused on smog and air quality emissions. The social media feed, which is driven by bottom-up coverage of events, has been dominated by two main groups of information: emotional, high-profile posts about environmental problems and green initiatives or regulations. These kinds of feeds attract much traffic; hence the increase in the number of posts, likes, and comments.

Finally, these results indicate that the media tend to be out of touch with the societal values and evolving identities, in particular environmental identities and sustainable values. Mainstream media and social media are disjointed, as the former is driven by a business model that gives privilege to corporate interests, whereas the latter is shaped by the social and political interests of its users who challenge the discourse of privilege and power. Social networking sites bring about societal innovation through the activity of their users distributing information across their networks.

Thematic analysis of the sample of posts and tweets showed a moderate variation in discussed topics. Public opinion is grouped around the themes of animal rights, pollution, commendation of green regulations and behavior, and condemnation of environmentally harmful behavior. Therefore, social networking sites have become a forum for expressing pro-environmental values and attitudes towards energy sustainability. This finding is in line with Reyes-Menendez, Ramon Saura, and Alvarez-Alonso [41] who differentiated various positive, negative, and neutral topics that raise public concern or attract public praise. It may therefore be concluded that posts perform two key functions: promoting pro-environmental behavior and condemning behavior that is unsustainable. However, the concerns of Polish social media users diverge from concerns identified by the previous research, as other studies [44] pointed to global health issues as one of the main topics that are discussed on social networking sites.

In conclusion, it needs to be emphasized that identity is not a state but a process which is formed by socio-cultural requirements. Although actions are culturally predetermined, an individual can influence the process of identity formation when he or she consciously strives to get to know social norms that control life in a given environment. Furthermore, individuals may explore their identity in a situation of dialogue which entails the negotiation of meaning and forming cultural identity. Hence, sustainable values might affect the process of identity formation. That is why it is important to raise awareness of sustainable values, thus promoting the change. However, in order to maintain the behavior change over time, habitual behavior needs to become a part of one's self-identity [50]. Social media is a popular platform that can be used to promote sustainable values and facilitate a long-term change in social media users' attitudes towards pro-ecological and pro-social behavior.

Social media mining offers an insight into the problems and solutions regarding sustainability issues ranging from smog pollution to natural resources management. Social media-based research can be used to gauge public opinion, which has numerous advantages such as low cost, as the data are already in the public domain, and ease of use, as machine algorithms provide analyses that are very reliable [43,51]. Furthermore, the findings of this investigation provide insights for organizations, communities, and companies that strive to implement sustainable programs and initiatives. Quantitative studies are also important for authorities to evaluate their performance regarding the implementation of sustainable policies [41]. Continued efforts are needed to support policies aimed at supporting sustainable growth. The research clearly shows an increased and consolidated interest in green issues, which is translated into environmental identity. Finally, due to their growing popularity, social networking sites have enormous potential as a powerful contextual influence on promoting sustainable values. As Everard, Reed, and Kenter [52] argued, "society progresses not (generally) through top-down leadership, but instead through progressive formalization of values expressed, shared and moderated, then consol-

idated by societal processes." Therefore, all the issues and outcomes we value should not be considered in isolation from the socio-ecological systems of which they are a part [53]. Social networking sites provide a context in which users not only reinforce their beliefs and values, but also mimic the behavior of other users. This mimicry leads to the formation of a social media identity bubble that reinforces shared identity and social homophily [54].

7. Conclusions and Practical Implications

This study set out to explore the shift in the formation of environmental identity throughout the course of the two-year study period (2018–2020). The findings clearly show a growing interest in sustainability issues that is reflected by an increase in the number of posts, likes, and comments concerning renewable energy and environmental issues. The density of the online debate is independent from the news coverage of environmental topics. Furthermore, the COVID-19 pandemic that induced general fear and threat did not result in a stalling of interest in sustainable values, as environmental issues even attracted increased attention during the COVID-19 pandemic and the national lockdown. The content analysis of posts shows that social networking sites have become a forum for promoting green behavior and sustainable values. Therefore, the hypothesis of this study has been confirmed and the findings prove that environmental identity has been consolidated over the two-year study period. However, further study is needed to explain the status of the identity maturity of social media users.

Since identity formation is a lifelong process consolidated in the socio-cultural milieu, it is important that the public debate on sustainable values and green behavior is promoted. Social networking sites provide a contextual influence on other users, which supports the development of a social media identity bubble that reinforces shared identity [54] and promotes a long-term attitudinal change towards sustainable behavior. In order to support long-term behavioral change, habitual behavior needs to become a part of one's self-identity. Promoting environmental identities on social media is a low-cost and socially acceptable way of promoting 'green' lifestyles. Building a sustainable society is a long-term process [55] that requires adjustment in individual behavior towards consistent and responsible actions that support the balance between economic, social, and environmental predictors of sustainable growth.

The study has several implications for energy security. Energy security is closely related to institutional stability [56], which provides consumers with plenty of opportunities for engaging in sustainable behavior. Energy security is a public good [57]; therefore, promoting sustainable behavior and environmental identity ought to be a key imperative of public policy. Undeniably, both renewable energy projects and supporting green behavior on social media are necessary, but the role of grassroots activities supporting sustainable energy consumption cannot be underestimated. Changing individual citizens' attitudes towards sustainable behavior may encourage them to maintain long-term sustainable behavior that will translate into relevant long-term sustainable policy making. Finally, even though individual states shape their own energy policy, a coordinated international response is necessary to provide energy security, including decarbonization of energy systems [58]. This paper examines an important concept of environmental identity and energy sustainability that needs to be taken into account when formulating economics- and politics-based public policy of sustainable growth. Social issues associated with energy and environmental safety need to be taken into account in order to enable effective governance.

Therefore, this study offers a multidisciplinary perspective on sustainable development that could drive equitable energy security and environmental security.

This study is limited because it did not differentiate between posts and reposts, which might have affected the study sample. A thematic analysis was performed to establish dominant themes; however, further qualitative analysis could identify the topics that were the most appealing for the public. Furthermore, the corpus contains posts and tweets in Polish only. Another limitation is that the publication of a pro-environmental post or comment does not have to result in behavioral change. Therefore, further research is needed to prove that environmental identity has been consolidated. Finally, despite the popularity of social networking sites, Facebook and Twitter users do not represent the whole population. Social media communication tends to be strongly polarized and affected by an echo chamber and trench warfare dynamics (a situation where opinions are reinforced due to a confrontation with opposing arguments) [59]. Nevertheless, public opinion about green issues expressed on social media has to be acknowledged. Further research into the development of environmental identity is necessary.

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