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**Communicating about climate change mitigation
on social media: Multimodal analysis of Instagram
posts by Belgian, French, and Norwegian opinion-
leading individuals and organizations**

Yuliya Samofalova

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Jury members

President: Prof. Antonin Descampe

Supervisor: Prof. Andrea Catellani

Supervisor: Dr. Louise-Amélie Cougnon

Other Jury Members: Prof Øyvind Gjerstad, Prof Céline Pascual Espuny

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Abstract

Climate change is an urgent global issue requiring culturally relevant communication to foster sustainable practices. Despite diminished media coverage during the COVID-19 pandemic, the urgency of addressing the climate crisis remains relevant. In this study, we highlight the pivotal role of Instagram in shaping environmental discourses, emphasizing that communication effectiveness frequently depends on aligning opinion leader content with their established image and expertise.

Focusing on Instagram, one of the most popular visual social media platforms in Europe, the research examines the semiotic forms of discourses on pro-environmental efforts in the food, energy, and transport sectors as communicated by Belgian, French, and Norwegian environmental opinion leaders and opinion-leading organizations between January 2021 and March 2022. The study also evaluates how these messages are perceived by audiences in terms of obstacles to pro-environmental action and environmental values, contributing to a deeper understanding of the interplay between media content and audience attitudes.

We present an extensive corpus of Instagram posts (N=22882). Adopting a value-based approach from environmental psychology, this research draws on a mixed-method research design. We apply an automated content analysis based on a dictionary approach to select a specific corpus of posts concerning the food, energy, and transport themes. Multimodal content analysis of 2092 posts regarding the three sectors provides an overview of environmental discourses in Belgium, France, and Norway. To examine how the obstacles, values, and narrative roles are represented in the posts, we integrate multimodal discourse analysis and computer-assisted linguistic analysis. We combine content analysis, computer-assisted linguistic analysis, and sentiment analysis to investigate the obstacles, environmental values, and narrative roles that appeared in the comments.

By analyzing the variation in discourses shaping citizens' beliefs and actions towards pro-environmental behavior, this research provides insights into European opinions on solutions and barriers or obstacles to climate change mitigation in the three sectors. The findings have implications for future environmental communication strategies, highlighting the need for coherent digital communication and the potential of social media to motivate pro-environmental action. Besides practical implications, this study is a valuable methodological contribution combining different computational and manual approaches to social media data. In addition,

the collected corpora can be used for pedagogical implications for teaching Environmental Communication.

Résumé

Le changement climatique est un problème mondial urgent qui nécessite une communication culturellement pertinente pour encourager les pratiques durables. Malgré une couverture médiatique réduite lors de la pandémie de COVID-19, l'urgence de faire face à la crise climatique reste d'actualité. Dans cette étude, nous soulignons le rôle central d'Instagram dans la formation des discours environnementaux, en insistant sur le fait que l'efficacité de la communication dépend souvent de l'alignement du contenu des leaders d'opinion sur leur image et leur expertise.

En se concentrant sur Instagram, l'une des plateformes de médias sociaux visuels les plus populaires en Europe, la présente recherche examine les formes sémiotiques des discours sur les efforts pro-environnementaux dans les secteurs de l'alimentation, de l'énergie, et des transports communiqués par les leaders d'opinion environnementaux belges, français et norvégiens entre janvier 2021 et mars 2022. L'étude évalue également comment ces messages sont perçus par les publics en termes d'obstacles à l'action pro-environnementale et de valeurs environnementales, contribuant ainsi à une compréhension plus approfondie de l'interaction entre le contenu des médias et les attitudes du public.

Nous présentons un vaste corpus de posts Instagram (N=22882). Adoptant une approche fondée sur les valeurs de la psychologie environnementale, cette étude s'appuie sur un modèle de recherche mixte. Nous appliquons une analyse de contenu automatisée établie sur une approche par dictionnaire pour sélectionner un corpus spécifique de messages concernant les thèmes de l'alimentation, de l'énergie, et des transports. L'analyse multimodale du contenu de 2092 messages concernant les trois secteurs donne un aperçu des discours environnementaux en Belgique, en France, et en Norvège. Afin d'examiner en profondeur la manière dont les obstacles sont communiqués dans les modes verbal et visuel, nous menons quatre études de cas. Pour examiner comment les obstacles, les valeurs, et les rôles narratifs sont représentés dans les études de cas, nous intégrons l'analyse multimodale du discours et l'analyse linguistique assistée par ordinateur pour investiguer les posts choisis. Nous combinons l'analyse du contenu, l'analyse linguistique assistée par ordinateur, et l'analyse des sentiments pour étudier les obstacles, les valeurs environnementales, et les rôles narratifs qui apparaissent dans les commentaires.

En analysant la variation des discours qui façonnent les croyances et les actions des citoyens en faveur d'un comportement pro-environnemental, cette recherche donne un aperçu

des opinions européennes sur les solutions et les barrières ou obstacles à l'atténuation du changement climatique dans les trois secteurs. Les résultats ont des implications pour les futures stratégies de communication environnementale, soulignant la nécessité d'une communication numérique cohérente et le potentiel des médias sociaux pour motiver les actions pro-environnementales. Outre les implications pratiques, cette étude est une contribution méthodologique précieuse combinant différentes approches informatiques et manuelles des données des médias sociaux. En outre, les corpus collectés peuvent être utilisés à des fins pédagogiques pour l'enseignement de la communication environnementale.

Аннотация

Изменение климата – актуальная глобальная проблема современности, требующая культурно-ориентированной коммуникации для формирования практик устойчивого развития. Несмотря на снижение освещения в СМИ во время пандемии COVID-19, решение климатического кризиса не теряет своей актуальности. В данном исследовании мы подчеркиваем ключевую роль Инстаграм в формировании экологических дискурсов, в особенности, потому что эффективность коммуникации часто зависит от контента опубликованного лидерами мнений, их устоявшегося имиджа и экспертных знаний.

Сфокусировавшись на Инстаграм, одной из самых популярных визуальных социальных сетей в Европе, данная работа изучает формы дискурсов об экологических практиках в продовольственном, энергетическом и транспортном секторах. В особенности, мы представляем результаты анализов Инстаграм постов опубликованных бельгийскими, французскими и норвежскими лидерами мнений и организациями лидирующими в сфере устойчивого развития в период с января 2021 по март 2022 года. В исследовании также оценивается как эти посты воспринимаются аудиторией с точки зрения препятствий для внедрения экологических практик и экологических ценностей. Таким образом наша работа способствует более глубокому пониманию взаимосвязи между контентом про экологию и устойчивое развитие публикуемым в Инстаграм и мнением аудитории о данных проблемах.

Для этой работы мы организовали обширный корпус состоящий из 22882 постов из Инстаграм. Применяя ценностно-ориентированный подход из экологической психологии, данная диссертация опирается на смешанный метод исследования. Мы использовали автоматизированный анализ данных основанный на словарном подходе для отбора отдельной группы постов, касающихся тем еды, энергии и транспорта. Чтобы дать общее представление об экологических дискурсах в Бельгии, Франции и Норвегии, мы проанализировали 2092 поста, касающихся трех секторов, применяя мультимодальный контент-анализ. Данный тип анализа включает в себя анализ изображений, видео, текста и звука. Чтобы понять, как препятствия к адаптации целей устойчивого развития, экологические ценности и нарративные роли представлены в Инстаграм постах, мы объединили мультимодальный дискурс-анализ и компьютерный лингвистический анализ. Мы также использовали контент-анализ, компьютерный

лингвистический анализ и анализ тональности, чтобы изучить комментарии к выбранным постам.

Изучая различия в дискурсах, формирующих убеждения и действия граждан, направленные на проэкологическое поведение основанное на минимизации вреда, причиненного окружающей среде, данное исследование дает представление о мнениях европейцев относительно решений и препятствий на пути смягчения последствий изменения климата в трех секторах. Полученные результаты представляют важное значение для стратегий в коммуникации об экологических проблемах, подчеркивая необходимость последовательной массовой коммуникации и потенциал социальных медиа для мотивации проэкологического поведения. Помимо важной практической роли, данное исследование является ценным методологическим вкладом, объединяющим различные автоматические и неавтоматические подходы к данным из социальных сетей. Кроме того, собранные и опубликованные корпусы данных могут быть использованы в педагогических целях для преподавания экологической коммуникации.

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List of abbreviations

Abbreviation	Definition
AI	Artificial Intelligence
CAP	the Common Agricultural Policy
CC	Climate change
CEO	Chief Executive Officer
COP	The Conference of Parties
EELVFR	Europe Écologie les Verts
EU	The European Union
GDPR	the General Data Protection Regulation
GMO	Genetically modified organism
IPCC	The Intergovernmental Panel on Climate Change
MDA	Multimodal discourse analysis
ML	Machine Learning
NGO	Non-governmental organization
NLP	Natural language processing
OL	Opinion leader
OLO	Opinion leading organization
UK	The United Kingdom of Great Britain and Northern Ireland
UN	The United Nations
USA	The United States of America
SDG	Sustainable development goals
SUV	Sport utility vehicle
XR	Extinction Rebellion

Introduction

Climate change (hereafter CC) is one of the most crucial issues for human societies today, which “needs to be made culturally meaningful and relevant to people’s everyday lives” (Doyle, 2011, p. 142). In 2014, the Intergovernmental Panel on Climate Change (IPCC) drew attention to the necessity of reducing high-consumption lifestyles and approaching sustainable development to reduce greenhouse gas emissions and fight global CC (IPCC, 2014). One of the most recent IPCC reports offered policymakers scientific guidance on mitigation and adaptation strategies (IPCC, 2022b). In line with the demanded sustainability transition, the UN underlined “the inescapable role of media and communication in the mediation, adoption – or indeed, rejection – of more sustainable everyday cultures and practices designed to mitigate the effects of a warming planet” (Goodman et al., 2020, p. 2).

Since the COVID-19 crisis of 2020 and the infodemia (Lits et al., 2020; Sanna, 2023) that it has entailed, the CC issue has ceased to be “our most pressing concern” (Manzanedo & Manning, 2020) and is partially fading away in media coverage. Nevertheless, CC and engaging populations on climate action remain “as urgent as ever” (Webster et al., 2020). Restrictions associated with the pandemic have affected the ability to manifest the climate. To keep the action for mitigation alive, the communicators had to change their communication strategies, so many CC campaigns moved online. This shift highlighted the importance of communication media and motivated people to create coherent digital discussions “with hopes that they would foster a new participatory dialogue and free exchange of ideas” (Díaz-Pont et al., 2020, p. 6).

A large part of the world’s population establishes its relationship with CC on social media (Lewandowsky et al., 2019; Williams, 2015). Environmental NGOs, political parties and their leaders, as well as opinion leaders and laypeople, disseminate messages on CC and its mitigation: some to achieve their mission or promote their action, others to complain or even to disseminate fake news. In this context, including opinion-leading accounts from social media may be seen as a potential strategy to promote sustainability communication and sustainable lifestyles (De Veirman et al., 2017), specifically if the posted content matches the influencer’s image, behavior, and level of expertise (Boerman et al., 2022). In addition to this, individuals’ exposure to environmental media content, attitudes, and sense of environmental efficacy can positively affect pro-environmental behavior (Rice & Miller, 2023).

Based on the prominence of CC online discourses, the present research focuses on the communication spread by opinion leaders and opinion-leading organizations who actively post

their visual and verbal messages on CC mitigation online. In addition to this, they achieve a high level of engagement among their audiences (Choi, 2015; Xu et al., 2018). The CC topics they cover are often based on food, energy, and transport sectors, which require “rapid and far-reaching transitions” (IPCC, 2018, p. 15) and represent “immediate challenges for behavior change” (Newell et al., 2021, p. 15).

Thus, the present research project aims to analyze the social media **communication** of **Belgian, French, and Norwegian opinion-leading** accounts of **individuals** and **organizations** **regarding CC mitigation in the food, energy, and transport sectors** on **Instagram**, as it is one of the most frequently used visual social media in Europe (Newman et al., 2021). The choice of countries results from the global JPI Climate Solstice project “202CM. Overcoming Obstacles and Disincentives to Climate Change Mitigation: A cross-cutting approach by human and social sciences in which we take part” (hereafter the Project).

Over the last two decades, environmental communication has demonstrated a trend in incorporating different approaches from social sciences, including a value-based approach adopted from environmental psychology (Jarreau et al., 2017). Environmental psychology studies have provided several recommendations for communicating about CC to overcome the obstacles to its mitigation. Indeed, stronger endorsement of biospheric and altruistic values in communication can increase people’s pro-environmental intentions, while emphasizing egoistic or hedonic values can provide contrary effects (Bouman, Steg, et al., 2021; Bouman, Van der Werff, et al., 2021). In this study, we address multimodal communication about CC-related issues via one of the most popular visual social media in the EU, Instagram, since it can be used to share knowledge on CC mitigation with a broad spectrum of audiences and motivate pro-environmental action (San Cornelio et al., 2024). Specifically, **we integrate a value-based approach to CC communication** – which remains widely understudied (Fage-Butler, 2022) – and traditional methods in communication research **to understand how the obstacles to pro-environmental actions on individual and collective levels are represented in Instagram posts**. In addition, we adopt the theory of environmental values to verify whether egoistic and hedonic values are associated with the obstacles to pro-environmental actions.

Our main research questions are

1. What are the semiotic forms of individual and organizational discourses on climate change efforts in food, transport, and energy sectors communicated in the posts of Belgian, French, and Norwegian opinion leaders on Instagram between 2021–2022?

2. How are these messages perceived by the audiences in terms of obstacles to pro-environmental action and environmental values?

This study draws on an inductive mixed-method approach. Instagram posts from opinion-leading accounts communicating about CC were examined through a prism of multimodal content analysis, multimodal discourse analysis, and computer-assisted linguistic analysis. The comments, i.e., the audience's responses to these posts, were evaluated with the help of content analysis, sentiment analysis, and computer-assisted linguistic analysis.

This research project allowed us to examine the variation in discourses shaping citizens' beliefs and actions towards pro-environmental behavior and its criticism on Instagram. The results contribute to understanding European opinions and interests regarding barriers versus opportunities to mitigate CC in the food, energy, and transport sectors.

The present work comprises three parts: Literature review, Methodology and data, and Results and discussions.

Part 1 *Literature review* includes three chapters. In Chapter 1, we provide a literature review regarding the notion of CC and the possible obstacles and barriers to pro-environmental behavior in the three countries (Section 1.1), the development of CC communication within media studies in general (Section 1.2.1), social media (Section 1.2.2) and Instagram (Section 1.2.3) in particular. Section 1.3 reviews studies on individual and organizational environmental communication on social media. Chapter 2 deliberates different approaches to defining and identifying opinion leaders and opinion-leading organizations for environmental communication. Chapter 3 introduces methodological approaches relevant to the research project.

Part 2 *Methodology and data* includes one chapter. In Section 4.1, we present the research aims and objectives in detail. Section 4.2 delineates the selected corpus data, its collection, and ethical requirements. Section 4.3 introduces an elaborate methodology for this study.

Part 3 *Results and discussions* incorporates four chapters. Chapter 5 is devoted to the general examination of the corpus data and reflections on it. Chapter 6 summarizes the results and reflects on the effectuated multimodal content analysis. Chapter 7 consists of four case studies based on a mixed-method research design of specific posts about the obstacles to the sustainability transition regarding the food, energy, and transport sectors. Each case study is supported by the discussion and summary of results. Chapter 8 concludes the present work by

providing the summary of the study (Section 8.1), limitations and future perspectives (Section 8.2), and implications of the research results (Section 8.3)

Part 1 Literature review

Chapter 1 Climate change, its mitigation, and media studies

This chapter synthesizes the academic literature on CC and its mitigation to contextualize the research within media studies. Specifically, we start by discussing CC mitigation and environmental values relative to it (Section 1.1.1). Sections 1.1.2–1.1.4 delineate the barriers to CC mitigation observed in social sciences in Belgium, France, and Norway. Furthermore, we focus on the historical development of environmental communication from more traditional media such as newspapers, magazines, and TV (Section 1.2.1) to social media communication about CC and its mitigation (Section 1.2.2) and Instagram specifically (Section 1.2.3). Section 1.3 addresses the individual and organizational aspects of communication about climate change on social media platforms.

1.1 Climate change and its mitigation

As defined by the IPCC (2012, p. 956), CC is “a change in the state of the climate that can be identified (e.g., using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. It refers to any change in climate over time, whether due to natural variability or as a result of human activity.” To mitigate the effects of CC, the UN and IPCC working groups suggested sustainable development goals and environmental management strategies (General Assembly of the United Nations, 2015) that demand changes in individuals’ attitudes and behaviors.

In a broader sense, CC mitigation is “limiting carbon-intensive technologies, processes, and practices and developing and adopting clean technologies” (Constantino et al., 2021, p. 34). As the UN (2015) suggested, the 17 Sustainable Development Goals (SDGs) provide a concrete action plan with 169 targets. Moreover, the most recent report of Working Group II of the IPCC (2022b) recommended feasible climate responses and adaptation options for all SDGs at different levels of system transition, including the food, transport, and energy sectors. On the one hand, these actions “make possible the adaptation required for high levels of human health and well-being, economic and social resilience, ecosystem health, and planetary health.” On the other, they are necessary to limit the levels of global warming and avoid the limits to adaptation (IPCC, 2022b, p. 9).

Sustainability development is a complex approach to balance economic growth, social equity, and environmental protection, aiming to improve the quality of life while preserving the integrity of the environment (Servaes & Lie, 2015). In this work, we frequently use the term sustainability transition to highlight the transition from high- to low-carbon lifestyles, as suggested by the IPCC (2022b). This transition should be done in multiple sectors of our lives, such as land and ocean ecosystems, urban and infrastructure ecosystems, energy systems, and cross-sectors (IPCC, 2022b). In this work, we focus on the communication about the sustainability transition in the food, energy, and transport sectors, which are parts of global systems suggested by the IPCC (2022b).

In the food sector, the IPCC identified the impacts of CC on agriculture, animal and livestock health and productivity, sustainable aquaculture production and fisheries regulation, food security, and agroforestry. The main recommendations of this sector include developing agroecology, decreasing food waste, changing dietary behavior by reducing meat and dairy consumption, and buying local, seasonal food (IPCC, 2022a). In this thesis, these actions construct a basis for analysis of the communication about the sustainability transition in the food sector.

In their reports, the IPCC (2022a) attributed the transport sector to the impacts on cities, settlements, and infrastructures. This sector requires decarbonization and demotorization, which can be done by encouraging walkable cities and non-motorized transport, development of public transport infrastructures, expansion of electric vehicles, use of energy-efficient appliances, and share of other low-carbon fuels, i.e., hydrogen and biofuels. The analysis of the communication about the sustainability transition in this thesis aligns with the presented IPCC suggestions.

The improvement of the energy sector, according to the IPCC (2022a), incorporates resilient power systems, energy reliability, and energy diversification. Energy diversification includes renewable energy sources such as wind, solar, or hydroelectric. In addition, the IPCC highlighted the necessity of improving energy efficiency and storage. Our analysis of the communication about the energy sector is based on these suggestions.

The COVID-19 pandemic has demonstrated the importance of collaboration between governments, organizations, and citizens in acting during a time of crisis. This collaboration and strong commitment can also be used to support and accelerate the implementation of sustainable policies, thereby facilitating the achievement of the SDGs (Shulla et al., 2021).

However, such a transition may be challenging in practice because of insufficient political or public support for specific pro-environmental policies (Nielsen et al., 2020).

Moreover, increased levels of denialism and eco-anxiety do not facilitate the transition towards more sustainable lifestyles (Clarke, 2023; Mickey, 2022). CC denial, which can also be an ideological program, “rejects all or part of the consensus in climate science about the trends, attributions, and impacts of a generally warming Earth caused mainly by human emissions that will have many dangerous impacts around the world but affecting the poorest people most” (Jacques & Knox, 2016, p. 832). Eco-anxiety can be described as intensified feelings of fear, grief, and shame concerning ecological and health crises (Mickey, 2022). Ágoston et al. (2022) developed six categories of eco-anxiety, including fear for future generations, empathy as “secondary suffering,” conflicts, being disturbed by changes, mental health, helplessness, and frustration. An adaptive response to them can contribute to a person’s pro-environmental behavior and individual well-being. This response can be closely related to the person’s environmental values.

The academic literature provided different obstacles and barriers to CC mitigation in general (Gifford, 2011; Lorenzoni et al., 2007) and regarding different sectors, including the adoption of electric vehicles (Egbue & Long, 2012) or the adoption of vegetarian lifestyles (Bryant et al., 2022). As in the previous studies, the terms “obstacles” and “barriers” are interconnected in this work and are used as synonyms to describe the challenges that restrain or complicate the efforts to reduce greenhouse gas emissions and mitigate the effects of CC. These obstacles are frequently linked to value-based studies in environmental psychology (Bouman, Van der Werff, et al., 2021; Gifford, 2011), communication (Whitmarsh & O’Neill, 2011), sociology (O’Brien & Wolf, 2010), and other disciplines. Indeed, a value-based approach to environmental communication represents a promising research area (Fage-Butler, 2022). The following section details several value-based approaches relevant to this study.

1.1.1 Climate change mitigation and environmental values

Values play a critical role in the context of CC, as they influence trust levels, for example, in scientific or political authorities, and form the foundation for attitudes that subsequently drive behavioral responses (Fage-Butler, 2022). Gecas (2000) described values as perceptions or convictions regarding preferred behaviors or conditions that go beyond particular circumstances, providing direction for decision-making and event assessment, which function

as benchmarks for living and objectives pursued by individuals. The pandemic crisis showed that citizens were confronted with uncertainty around scientific proofs, which emphasized the vital role of the transparency of values (Klenert et al., 2020). As a fundamental part of human beings (Trillò et al., 2021), these values influence environmental behavior alongside the person's political orientation (Smith & Hempel, 2022).

In general, the value-based approach was developed in different social sciences, such as sociology (Guilhaumou, 2017), psychology (Maio, 2016), and semiotics (Greimas, 1973). In this study, we adopt a psychological approach to values since its contributions are frequently adopted by studies in environmental communication. In psychology studies, attitudes are positive or negative evaluations of an object whose essential function is to express values. In their turn, values are judgments of importance and motivational guides. The patterns and strengths of relations between attitudes and values vary according to the social and environmental contexts (Maio, 2016).

More broadly, communication studies describe attitudes as feelings or opinions about a situation, while values are the importance of certain states or affairs over others (Hofstede, 1998). In environmental communication, attitudes can be people's opinions about CC and proposed solutions, and values are linked to the motivations driving or not pro-environmental efforts. Such attitudes can be explicit or implicit. Explicit or self-reported attitudes may not always reveal a person's true thoughts due to social pressure or the necessity to assimilate their personal attitudes into a social group they take part in (Gong et al., 2023). Implicit attitudes are automatic or unconscious beliefs or feelings that can influence people's perceptions of CC (Sun et al., 2020). The studies demonstrated the influence of implicit attitudes to indifference about CC, which should motivate policymakers to include emotional and personal communication strategies to discuss CC-related issues (Gong et al., 2023).

A value-based approach to CC developed from different social sciences perspectives: political studies, sociology, and psychology. The study of climate risk perceptions and policy support of the US public revealed that CC imagery and cultural values can influence support for national climate policies (Leiserowitz, 2006). More precisely, four values from cultural theory – egalitarianism, fatalism, hierarchism, and individualism – were extracted from the results of a public survey, where egalitarianism, individualism, and hierarchism “were significant predictors of global warming risk perception” (Leiserowitz, 2006, p. 57).

According to Schwartz (1992, p. 21), values are “desirable goals, varying in importance, that serve as guiding principles in people’s lives.” One of the most important characteristics of values is their universal nature based on strong social consensus, which allows the values to be accepted as self-evident. In other words, people in the world share values, such as caring for other people, to some extent. The classical value models, as the one proposed by Schwartz (1992), fit better in “more developed nations than in poorer, less developed nations” (Maio, 2016, p. 37). However, Bombaerts et al. (2023) validated Schwartz’s typology of values for studying energy justice in social sciences.

Schwartz’s model of value typology includes 19 types of fundamental values (Schwartz, 2017), which other scholars frequently utilize to study the effects of values on people’s pro-environmental intentions. For example, by conducting a survey study, Lucas (2018) adopted Schwartz’s value typology to analyze public concerns and unconcerns regarding CC in Australia. This study underlined that care for nature could motivate pro-environmental actions, while social order, tradition, freedom, and choice may be important factors for inaction.

The latest research in environmental psychology has adopted various categories of values to examine people’s intentions and attitudes toward pro-environmental behavior. Dietz (2015) argued that individual decisions about the environment depend primarily on three types of values: self-interest, altruism towards other humans, and altruism towards other species (Dietz, 2015). This study is closely related to what De Groot and Steg (2008) showed in practice in the early 2000s. They suggested that altruistic, egoistic, and biospheric values can be relevant to a better understanding of people’s intentions related to environmentally significant behavior. More recent research complemented the previous typology with hedonic values (Bouman et al., 2018). Consequently, the most recent typology of environmental values includes four major environmental value clusters: biospheric, altruistic, egoistic, and hedonic. These studies based their value classifications on Schwartz’s value typology.

The researchers define *biospheric* values as concern and care for nature and the environment. Examples of biospheric value include preventing pollution, protecting the environment, respecting the earth, or unity with nature. *Altruistic* values reflect care about other generations, social welfare, and society in general. They include equal opportunities for all, care for weak people, peace in the world, and working for the welfare of others. *Egoistic* values reflect concern for personal resources such as possessions, money, and status by drawing attention to social power, authority, influence, wealth, and ambitions. *Hedonic* values focus on

pleasure, positive feelings and emotions, and comfort by doing pleasant things or reducing efforts (Bouman et al., 2018; Bouman, Van der Werff, et al., 2021).

The previous research on examining the influence of environmental values towards pro-environmental behavior was predominantly focused on conducting and analyzing public questionnaires or interviews in Spain (Corraliza & Berenguer, 2000; Fraj & Martinez, 2006); Japan, Bangkok, Thailand, Philippines, the Netherlands (Aoyagi-Usui et al., 2003); New Zealand (Fairweather et al., 2005); the USA (Brody et al., 2012; Dutcher et al., 2007); the Netherlands (Boeve-de Pauw et al., 2014; Poortinga et al., 2004; van der Werff et al., 2013); the UK (Gatersleben et al., 2014); France (Faburel, 2015); the USA, Germany, China (Ziegler, 2017). The results of these works show that whereas biospheric and altruistic values relate to each other and motivate pro-environmental behavior, egoistic and hedonic values can represent obstacles to it. As such, while taking public transport for some people is beneficial because it is less expensive than private means of transport (positive endorsement of egoistic value), for others, it can seem uncomfortable and, therefore, represent a barrier on a hedonic level (Bouman, Van der Werff, et al., 2021). Thus, “widespread climate action seems most likely when biospheric values are endorsed strongly throughout society, and when people act on these biospheric values” (Bouman, Steg, et al., 2021, p. 103).

The mass media can be an effective channel to promote environmental values (K. Lee, 2011). Some studies attempted to analyze the influence of the press and social media on people’s political and cultural values (Scherman et al., 2015). However, they were mainly focused on press coverage or survey data. In this context, there is great potential in combining the value-based approach to social media data about CC (Fage-Butler, 2022), which will undoubtedly offer new possibilities to understand users’ motivations and critics of pro-environmental behavior.

To summarize, the value-based approaches were developed in different disciplines within social sciences and adopted in environmental research since values can be used as motivation drivers for pro-environmental action. The studies applying the classical value typology by Schwartz differ across disciplines. However, they are all united by their intentions to improve communication about CC mitigation. In this context, we propose to combine a value-based approach developed in environmental psychology with research methods in information and communication sciences to investigate social media communication about CC mitigation in Belgium, France, and Norway, which are the countries within the scope of the

Project. The main reason for this combination is a robust environmental value classification proposed by Steg et al. (2014) and Bouman et al. (2021). In the following sections, we contextualize the adaptation measures in the food, energy, and transport sectors in the three countries.

1.1.2 Climate change mitigation: Belgian context

Being a heart of the European Union, Belgium represents a particular interest for researchers in environmental communication due to a set of intergovernmental cooperation practices oriented towards sustainability transition (Van den Brande, 2012). Belgian municipalities integrate and adjust these broader sustainable development policies and international campaigns (Devuyst & Hens, 2000). Like many other countries, Belgium has developed various objectives concerning the 17 SDGs covering all sectors of life, including food supplies, transport infrastructures, and energy production. A recent Sustainable Development Report showed the advances achieved in the three sectors (Sachs et al., 2023).

One of the first potential trajectories in the food sector in Belgium was based on the necessity of agroecology development, i.e., integration and improvement of nature management and food production (Stassart et al., 2012). It was further complemented by such goals as doubling agricultural productivity, increasing the revenues of agriculture workers, improving sustainable agriculture, and making healthy food accessible to all citizens (Vander Beke, 2016). Today's significant challenges in Belgium lie in regulating pesticide use and export (Sachs et al., 2023).

On the individual level, reducing meat consumption and consuming organic products are largely promoted in the country. The study of norms, values, and behaviors of young adults in Flanders revealed that repeatedly purchasing sustainable food products can lead to sustainable habits (Vermeir & Verbeke, 2008). Another research on the opinions of Flemish people highlighted that consumption of organic meat, reducing meat intake, and opting for sustainable fish are embraced, although the readiness to pay is lower compared to the willingness to consume. Other barriers to the change in this study were the lower quality of plant-based meat alternatives and their negative impact on people's health (Vanhonacker et al., 2013). These results demonstrate the connection between the obstacles to pro-environmental action in the food sector and egoistic and hedonic values, i.e., the desire to make economies, take care of personal health, and enjoy the taste of food expressed by some people. However,

another study showed that a high number of Belgian citizens, more than fifty percent of consumers, substitute meat at least occasionally (Profeta et al., 2021). In this context, it seems important to understand the reasons for this shift and identify the communication strategies that can effectively promote eco-friendly lifestyles.

The recent data provided by the International Energy Agency (2022) showed that Belgium's total energy supply consists majorly of fossil fuels (e.g., oil (36%) and natural gas (25,3%)), nuclear energy (22,5%), coal, followed by a relatively small share of renewable sources, such as wind or solar energy, and biofuels (Figure 1).

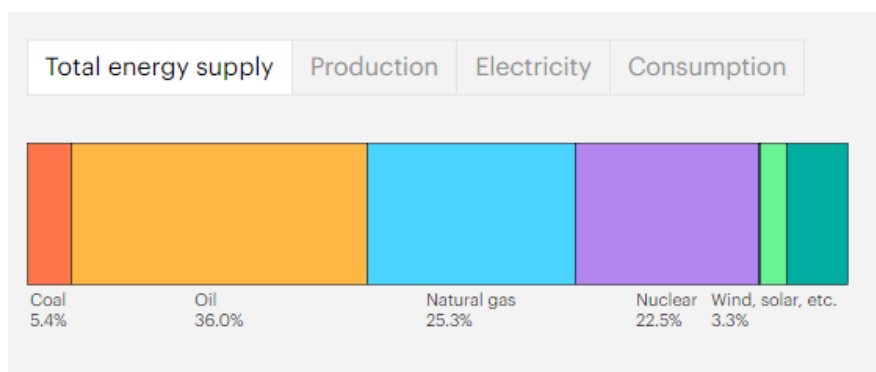


Figure 1 Total energy supply in Belgium in 2022. The graph was made by the International Energy Agency.

Therefore, the sustainability development plan in the energy sector suggests increasing the number of renewable energies, improving energy infrastructures, and rationalizing the funding of fossil fuels, including restructuration of taxation and progressive elimination of detrimental subsidies (Vander Beke, 2016). Although the report by Sachs et al. (2023) showed an increased level of renewable energies in Belgium since 2000, significant challenges should be resolved in renewable energy share, and cutting down the emissions from fossil fuels. In general, the IPCC (2022a) identified nuclear energy as a mitigation strategy in the energy sector. It is possible that this suggestion and the energy crisis that appeared in 2022 with the beginning of the war in Ukraine could influence the growth of pro-nuclear views among Belgian citizens (Taylor, 2023).

In the transport sector in Belgium, three primary goals for the transition are observed: (1) making transport more accessible, (2) improving transport security (Vander Beke, 2016), and (3) improving public transport (Sachs et al., 2023). In addition to these measures, the

Federal Government plan (2021) proposed to decrease the number of individual cars and their environmental impacts. The plan specifically suggested moving towards zero-emission vehicles, increasing the budget to support alternative mobilities, supporting car-sharing services and platforms, and moving towards carbon-neutral company cars. Nevertheless, some young citizens in Belgium consider these measures not effective. This is, in particular, due to the fact that the conventional model of households having two cars remains essential in regions where public transportation options are scarce, car-sharing services are uncommon, and railway networks are not well-developed (Anciaux et al., 2023).

The role of media in Belgium is significant in its contribution to the political and policy processes (Gorp & Sinardet, 2017), including the policies on sustainability transition. The media attention to CC issues in Belgium fluctuated from 2000 to 2016 (Pepermans & Maesele, 2017). Besides this, we observe an essential role of social media in disseminating information about sustainability transition in the food, energy, and transport spheres, which can be used to identify the obstacles to CC mitigation. For instance, the report on Twitter data produced within the Project by Pizarro et al. (2022) provided some expressions related to these obstacles, such as *problème* or *défi*. It also highlighted the increased number of obstacles through time, “which might indicate that people experience more difficulties in taking action against climate change, or that there is more awareness of the difficulties” (Pizarro Pedraza et al., 2022, p. 24). Belgian citizens frequently use social media platforms. Indeed, social media represent the third most important source of information in Belgium. However, the Belgians trust information obtained from these media to a limited extent, yet more than in online news platforms, video platforms such as YouTube, and social network influencers in particular. The most trusted sources of information for Belgians are TV programs and the press, which are also the most frequently used platforms to obtain information including CC-related content (Cools, 2023).

In summary, Belgium demonstrates a long-term commitment to sustainability transition in the food, energy, and transport spheres. On the one hand, the country attributes an important place in this transition to government policies and regulations. On the other hand, as stated on the portal Belgium, an essential role in sustainability transition is attributed to citizen initiatives, such as unions, associations, NGOs, schools, and youth movements initiated by Federal authorities (*Sustainable Development Goals*, 2023). In this context, the role of both traditional and digital forms of media is increasing and presents a high potential for researchers considering the existent reality of low trust levels in the communication of digital influencers, as discussed

above. Some studies attempted to understand digital communication regarding the sustainability transition in Belgium by focusing on Twitter data in Flanders (Moernaut et al., 2022) or Instagram posts by climate activist groups (Samofalova et al., forthcoming; Samofalova & Marcella, 2023). However, there is a lack of a complex approach to understanding the obstacles to CC mitigation through multimodal data.

1.1.3 Climate change mitigation: French context

After joining the United Nations Framework Convention on Climate Change in 1992, the French national government and agencies initiated numerous programs and initiatives to address climate change issues and guide local authorities in implementing adaptation strategies, such as National Climate Plan in 2004, National Climate Change Adaptation Strategy in 2007, National Climate Change Adaptation Plan in 2011. Adapted to the local policies, these plans involve high participation of stakeholders, such as local politicians, civic organizations, local businesses, non-profit organizations, and media (Lioubimtseva & da Cunha, 2020). In 2021, regional French TV channels broadcasted content related to the European Union and the adoption of sustainable measures (Figure 2) covering such fields as fishing (34%), transport (14%, including the ban on the sale of combustion-powered cars), climate (4%), agriculture (3%, including the ban on the sale of combustion-powered cars), energy (3%), food (3%), and health (2%).

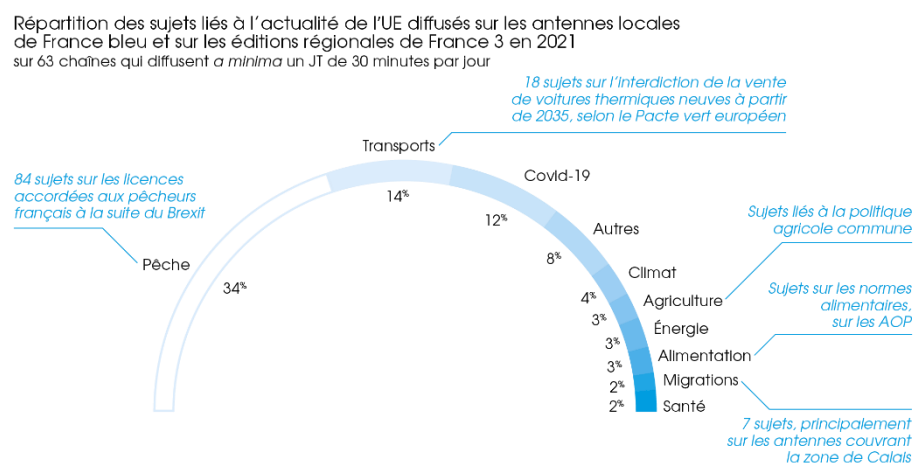


Figure 2 EU-related information broadcasted on France 3 local TV channels in 2021 (Source: <https://la-rem.eu/2023/11/moins-de-deux-minutes-pour-lactualite-de-lunion-europeenne-dans-les-medias-francais/>).

Figure 2 demonstrates that even though the transport, energy, and food sectors related to the EU regulations are discussed in the French broadcasting media, the topics related to sustainability remain underrepresented. In fact, the French national policies face barriers to the transition on local levels, such as reduction of subsidies, specific economic criteria, and, still, lack of awareness of climate issues (Simonet & Leseur, 2019). The lack of awareness of climate change and its causes has also been demonstrated by a recent report of *Ipsos/Sopra Steria* for *Le Monde*, *Fondation Jean Jaurès*, *Cevipof*, and *Institut Montaigne* (2023). The report showed that around 43% – higher than in 2022 – of the respondents are neither sure that CC exists nor believe in human causes of climate change. Among the possible solutions to CC mitigation, French citizens rely on modifying the types of production and individual lifestyles rather than technological progress. However, 12% of respondents still suggest that nothing can help limit the effects of CC. These results contradict another report, which showed that most people perceive CC as an essential problem and claim they want to do more for the climate (Parlons Climat, 2022).

Some trends regarding the SDGs in France have been identified and published on the government website, Agenda 2030. The statistics show slightly favorable improvements in organic farming, decreasing plant protection products, i.e., pesticides, development of renewable energies, and decreasing fossil fuels in primary energy consumption. In the transport sector, the tendencies remain quite unfavorable, particularly in such categories as the share of road transport and the share of collective transport (INSEE, 2022).

Even though the trends show increasing numbers of renewable energy sources, the country relies heavily on nuclear power for electricity production. The possible reasons for this were suggested in sociology research in the early 2000s. The article by Zelem (2002) highlighted that, generally, people in France believe that nuclear and fossil fuels are infinite resources that can not endanger the environment. Additionally, communication about renewable energies is neither sufficiently comprehensible nor accessible to laypeople. For example, many French people in rural areas can be engaged against installing windmills, as in the case of Saint-Brieuc in Brittany. They organize their opposition discourse via Facebook groups, which play a significant role as intermediary actors between local opposition and national politics (Quiroga Cortés, 2024). Finally, the choice of nuclear and fossil fuel energies is mainly based on centralized electricity production (Zelem, 2002, p. 89) and the countries' strategic choice regarding energy policies (*Histoire de l'électronucléaire En France*, 2016).

In a more recent economic and political situation, the energy transition has been particularly affected by the COVID-19 pandemic and the wars in Ukraine and the Middle East. In this context, the subject of nuclear and renewable energy sources remains still an object of debate. While renewable energy sources are becoming more competitive than fossil fuels, the energy transition is still challenging to implement without the contribution of nuclear energy (Fontanel, 2022), which should be sustainable (Kerboul, 2023).

The agricultural sector represents 20% of annual CO₂ emissions in France, with the majority of emissions related to animal farming and fertilizers (Ferrand & Trotignon, 2023). The Climate Law adopted in 2021 in France introduced two possible ways of transitioning to sustainability in the food sector: food consumption and work on the land. It means that the country should support sustainable food production and develop agroecology (Grimonprez, 2021, p. 2). Sustainable food or *alimentation durable* here is related not only to the consumed products but also to the behaviors to be adopted, including such eco gestures as taking enough time to eat, fostering short distribution channels (Benamouzig & Boubal, 2022), or reducing daily calories intake and regulating food waste (Berthou, 2023). These practices can be adopted on individual and local group levels and are largely discussed in the media (Boutaud et al., 2020).

Institutional food services can implement different sustainable practices to reduce their environmental impacts, such as organic food, vegetarian meals, food waste management, and occasional use of ultra-processed food, i.e., food that has undergone significant industrial processing. However, in this case, the practice of ultra-processed food is a controversial solution (Martin et al., 2022). Vegetarian menus in schools are one of the sustainable practices supported mainly by the main green political party in France – Europe Ecologie Les Verts¹. In some French cities, such as Dijon, the practice of vegetarian meals in schools was evaluated through the nutritional qualities and greenhouse gas emissions and confirmed to be a good strategy for sustainability transition (Dahmani et al., 2022). Nevertheless, this subject remains largely debated in the French media (Chauviat & Hugol-Gential, 2023).

¹ <https://www.eelv.fr/>

In 2019, a digital journal ADN stated that French people are aware of and somewhat interested in veganism but are not ready to change their food habits (Huot, 2019). In 2022, Reporterre (Media of Ecology) wrote that the highest meat consumption is observed amongst the working class, where people associate meat with well-being and prestige (Bourelle, 2022), which refers to the egoistic values of Bouman et al. (2018). A recent report by *Réseau Action Climat* and *Société Française de Nutrition* (2024) showed French people consumed meat twice as much as citizens in other countries in 2023 and, therefore, the organizations recommended reducing individual meat consumption to no more than 450 grams of meat per week, including all meats. In addition, they recommend daily consumption of 65–100 grams of vegetables on the individual level. On the institutional level, the government is advised to support professionals with guidelines and tools in sustainability education which can help individuals adapt to these changes, taking into account economic and social inequalities (Réseau Action Climat & Société Française de Nutrition, 2024). This report has initiated numerous discussions in the French media: France Info², Le Monde³, and La Croix⁴ dedicated articles about this theme on their websites.

In addition to the debates around vegetarian food menus, the agricultural sector in France is taking a controversial position towards sustainability transition. The Interbev – The National Organisation of Interprofessionals in Cattle and Meat Industry – contributes largely to the ambiguity of eco-responsible food consumption. In their advertising campaign, which is spread by the website Naturellement Fléxitariens⁵ and on their social media pages, environmental and health concerns are mentioned in vague and conventional ways. Specifically, the initial concept of the flexitarian food menus, as an individual tending towards vegetarianism through his or her beliefs and eating habits, has been stripped of all its substance by Interbev communication. Such confusing communication about meat consumption and the

² https://www.francetvinfo.fr/sante/alimentation/alimentation-les-francais-devraient-diviser-par-deux-leur-consommation-de-viande-selon-une-etude_6377290.html

³ https://www.lemonde.fr/planete/article/2023/06/01/un-francais-consomme-deux-fois-plus-de-viande-que-la-moyenne-mondiale_6175784_3244.html

⁴ https://www.la-croix.com/france/la-viande-une-passion-francaise-20240220?utm_source=newsletter&utm_medium=email&utm_campaign=NEWSLETTER__CRX_ESSENTIEL__MIDI_EDITO&utm_content=20240220

⁵ <https://www.naturellement-flexitariens.fr/>

ambiguity of certain food labels may contribute to citizens' lack of understanding of sustainable solutions in the food sector (Denos et al., 2020).

To achieve SDGs, the French government develops sustainable transport policies and projects on different levels of urban and rural mobilities. In urban areas, the proposed pro-environmental actions include 1) discouraging automobile use by increasing paid parking areas and their prices and 2) improving public transport by expanding the network and developing pedestrian and cycling layouts (Reigner & Brenac, 2019). In the aviation industry, there is a necessity to improve travel trajectories and to develop ultra-sustainable airplanes that use biofuels (Auverlot & Sauvant, 2023). On the individual level, using electric vehicles can be a possible way to mitigate CC; however, it is perceived by many French citizens as a controversial solution (Wagener, 2024).

Local mobility is one of the determining factors of ecological transition, which has a complex governance structure and is a source of debate. While there is a lack of sufficient funding for public transport in France, it may be interesting to develop carpooling and car-sharing practices in rural areas (Flipo et al., 2021) and multimodal transportation, i.e., combining diversified mobility practices (Rocci, 2017). These practices, however, should be compatible, integrated, and acquired by laypeople. Furthermore, political discussions frequently utilize individual responsibility as an essential factor in the sustainability transition in the transport sector (Flipo et al., 2021). Rocci (2017) identified the following obstacles to the transport sustainability transition: 1) lack of knowledge and information about the transport system, 2) the force of personal habits, 3) inadequate perception of transport alternatives, 4) incertitude and lack of experience with new transportation practices. The strategically constructed and disseminated information about new transportation practices plays a vital role in overcoming these barriers (Rocci, 2017).

To recapitulate, France attempts to achieve SDGs on different levels within multiple sectors, including food, energy, and transportation. Some of the suggested pro-environmental practices are adopted on the institutional level, such as the choice of vegetarian menus in schools or better options for public transport. Other actions require individual participation, for instance, using sustainable modes of transport, choosing renewable energy providers, or planting their own fruits and vegetables. Better communication about the new sustainable practices may be considered one of the most effective tools for dealing with difficulties in adapting to eco-responsible lifestyles.

1.1.4 Climate change mitigation: Norwegian context

Norway represents an interesting case study for the project, given its status as a well-established state primarily attributed to its extensive oil and gas production, which is, however, “strongly criticized and debated, both in Norway and abroad” (Fløttum et al., 2023, p. 393). Nevertheless, CC occupies a prominent position in the Norwegian political landscape and receives extensive coverage on different media platforms. As one of the countries with a well-developed economy, Norway’s adaptation to the sustainability transition includes the development of inner policies and measures and facilitating sustainable infrastructure development for developing countries (Statistics Norway, 2022).

In line with SDGs and our focus topics – food, energy, and transport – Norway’s agenda includes ensuring sustainable infrastructure, improving urban air quality, halving food waste, and reducing waste generation (*Norway’s Follow-up of Agenda 2030 and the Sustainable Development Goals*, 2016). In 2020, Norway achieved the sixth position in the world in terms of its overall SDGs score (Sachs et al., 2023). The indicators for implementing different measures in the food, energy, and transport sectors continue to grow. As such, there is an increase in the overall renewable energies share in 2021 – 74,1% now compared to 64,4% a decade ago (Statistics Norway, 2021). Although Norway seems to be on track with SDGs, there is still work to be done to integrate the SDGs into action plans and planning tools on different levels of administration, in particular in small municipalities (Bardal et al., 2021). Furthermore, more work should be done on sustainability education concerning SDGs since some Norwegian citizens consider this concept unknown or express negative attitudes towards SDGs (Fløttum et al., 2022). Thus, many researchers see a high potential for developing sustainability education in Norway (Heggen, 2016).

Regarding sustainable development in the energy sector, Norway’s main challenge lies in exporting oil and gas to other European countries (Fischer et al., 2018) and transitioning from non-renewable to renewable energy sources (Eilu et al., 2021). To overcome this challenge, the country envisions the development of deep-sea mining to harvest metals, such as copper, lithium, titanium, zinc, and cobalt, which can be used for solar farms, wind turbines, and electric vehicles (Adomaitis, 2021). While the researchers encouraged the development of a Nordic mineral deposit database and research on the extraction and further recycling of these metals (Eilu et al., 2021), environmental organizations, such as Greenpeace, expressed their concerns about this issue on their websites. The NGOs discussed the vulnerability of the Arctic Sea

ecosystems and coastal communities, which can be impacted by deep-sea mining, and suggested pressuring the Norwegian government to abandon its proposal for deep-sea mining in the Arctic (Oyonarte & Grønbeek, 2023). In addition to this, a lack of understanding of some key terms related to deep-sea mining by different stakeholders, including government members and businesses, may complicate the regulations of deep-sea mining policies (M. Conde et al., 2022). In this context, we may also suggest that communication about this issue can become vague and may confuse other people.

Norwegian citizens perceive the energy transition from fossil fuel to renewable energy differently in terms of their socio-demographic positions. On the one hand, there is a shift in perceptions of fossil fuels amongst Norwegian energy elites, who, due to their professional reorientations, attempted to promote energy transitions and encouraged societal change between 2018 and 2020 (Rauter, 2022). On the other hand, the public perceives energy transition as a distant issue compared to everyday life and employment concerns (Tvinnereim et al., 2020). Unfortunately, there is no research on citizens' opinions regarding the development of deep-sea mining to support sustainability transition by the time of the presentation of this thesis.

In the food sector, Norway's major political targets lie within the production and consumption of organic food (Vittersø & Tangeland, 2015), reducing red meat production and consumption (Miljødirektoratet, 2020), fishing regulation by the government policies (Schønning et al., 2023). At the same time, workers in the agricultural and fishing industries see a high potential for finding "innovative technological solutions" to mitigate the effects of CC (Karlsson & Hovelsrud, 2021). Another study showed that coopetition – cooperation of competitors "on other value-adding activities within the same supply chain" – in the fishing industry could also improve the adaptation to sustainability goals for fishing companies (Harun et al., 2022).

Compared to Belgium and France, the Norwegian population seems to follow vegan, vegetarian, or pescatarian food regimes more easily. The most recent World Population Review reported 9% of vegetarian citizens in Norway, 7% in Belgium, and 5,2% in France. However, the researchers observed that Norwegian citizens are uncertain about embracing the change towards environmentally friendly food choices, primarily due to their limited awareness of the environmental impact of meat consumption and their reluctance to accept this responsibility as consumers. Offering more information about scientific evidence of CC impacts and solutions

to its mitigation could contribute to the increase in sustainable food choices (Austgulen et al., 2018). A more recent work by Bertella (2020) showed similar results: The findings indicated that non-vegans' limited understanding or lack of knowledge about veganism, coupled with instances of open hostility, pose significant barriers to vegans in their pursuit of food-related happiness. Nevertheless, this food-related happiness is highly connected to vegans' sensory appeal of the food, when describing the taste and the quality of the food. Thus, Bertella (2020) recommended that government bodies support vegans in their dietary choices. Another solution to facilitate the implementation of sustainable food practices on an institutional level can be prioritizing initiatives where environmental advantages coincide with cost savings and health considerations (Guillen-Royo et al., 2024).

Mitigating emissions from privately owned vehicles is significant in achieving global targets for reducing greenhouse gas emissions in Norway. The Norwegian National Transport Plan 2018–2029 stated that new cars sold by 2025 should be either zero-emission or low-emission (Ingeborgrud & Ryghaug, 2019). To support this transition, the country supports the development and use of different sustainable transport modes, such as electric ferries (Tarkowski, 2021), electric cars (Hasan, 2021), electric bikes (Simsekoglu & Klöckner, 2019), multi-modal transportation (Babri et al., 2023). To promote the use of electric vehicles, Norway combined various national and local policies concerning industry development and citizens' demand (Ryghaug & Skjølsvold, 2023). While there is a significant increase in the purchase of individual electric vehicles in Norway (Anfinsen, 2021), the obstacles to the transition lie mainly within the use of public transport. For example, young and active users of new communication technologies tend to have negative attitudes toward public transport due to their high expectations, which can be problematic to fulfill (Julsrud & Denstadli, 2017). Another study revealed that multi-modal transport initiatives targeting air emission reductions in one section of the transport network could negatively affect another segment. Specifically, implementing a net zero emission policy for sea traffic could worsen road traffic, resulting in an unintended rise in emissions on a broader scale (Babri et al., 2023).

A group of researchers from Bergen investigated different perceptions of CC-related issues by Norwegian citizens from survey data. For example, Tvinnereim, Lægreid, and Fløttum (2020) combined quantitative and qualitative text analyses with sentiment analysis to investigate citizens' associations with such words as “*oil and gas*,” “*energy*,” and “*transition*.” The researchers showed that energy transition remains a distant theme for the public in relation

to other issues. In another study, Gjerstad and Fløttum (2021) identified key themes and different narrative characters in survey data. This study's key themes correlate with our focus topics: consumption (including food), transportation, politics, and energy. The most frequently mentioned characters were *I/me* as heroes in most cases and *we/us* (humanity) as villains most of the time (Gjerstad & Fløttum, 2021). More recent linguistics-based research on the opinions of young Norwegian citizens demonstrated youth's worries about the future of CC and provided insights into the efforts that young people make to mitigate the effects of CC. These efforts include mostly recycling, use of environmentally friendly transports, and reducing or giving up meat consumption (Fløttum et al., 2023). Although Norwegian citizens may not always struggle to identify the problem of CC, some of them can choose to disengage due to the complexity of climate change challenges, or they are not sure whether their efforts at CC mitigation make a significant difference (Fløttum, Gjerstad, & Skiple, 2021).

To summarize, Norway's policies are directed at a sustainability transition in different sectors, including food, energy, and transportation. Norwegian measures to achieve the SDGs include internal measures and contributions to facilitating sustainable infrastructure development for developing countries (Statistics Norway, 2022). Although there is a common understanding of CC and the necessity of its mitigation by different population groups, there is still a lot to be done on the level of knowledge transmission and communication in the three sectors. Thus, investigating communication about sustainable development in the food, energy, and transport sectors could contribute to developing better communication strategies and tools.

1.2 Environmental and sustainability communication: from traditional media research to new forms of communication

This section focuses on different approaches to environmental communication. Specifically, it draws attention to the historical development of this research field, from studying traditional media sources (Section 1.2.1) to social media in general (Section 1.2.2) and Instagram specifically (Section 1.2.3).

1.2.1 Environmental communication via traditional media sources

The terms “environment,” “climate,” “sustainability,” and other related concepts are frequently discussed in various media sources today. On radio, in the newspapers and magazines, on TV, and online, stakeholders discuss the causes and impacts of CC and propose solutions in different

spheres of our lives. While 2023 was recorded as the hottest year in history, the media coverage of CC and global warming decreased compared to the previous year (Nacu-Schmidt et al., 2024). This means that researchers should draw particular attention to environmental and sustainability communication since they remain challenging subjects in modern society.

For some researchers, environmental communication seems to be a relatively new area (Chadwick, 2017). However, the necessity of its development and the first steps to establishing the field appeared in the late 1970s and 1980s. For example, the *Science Communication* journal introduced new thematic sections dealing with the preservation or conservation of the environment, forests, endangered species, and environmental NGO communication in 1979 (Pezzullo & Cox, 2018). This step and the rapid development of CC studies contributed to creating a working group on environmental communication within the International Association for Media and Communication Research in 1988. After the first report of the Intergovernmental Panel on Climate Change (IPCC) in 1990 and the first Conference of the Parties (COP) in 1995 in Berlin, a large number of works appeared regarding CC, the environment, and communication about them. As a research field, environmental communication developed more rapidly since 2007, when the first issue of the *Environmental Communication* journal was published. The fifth report of the IPCC, sorted in 2014 and 2015, concluded that it is still possible to limit the temperature rise and the effects of climate change by reducing 40–70% of world emissions of greenhouse gases. Following this report, the political leaders agreed to limit the temperature rise to 2°C at the COP21 in Paris. The Paris Agreement is frequently used as a reference point for many communication studies (Pezzullo & Cox, 2018).

More largely, environmental communication is defined as communication about the issues related to the environment, which can serve as a practical tool for action (Meisner, 2015). As a multidisciplinary field, environmental communication “describes many ways and the forums in which citizens, corporations, public officials, journalists, and environmental groups raise concerns and attempt to influence the important decisions that affect our planet” (Cox, 2013, p. 11). In addition to this, environmental communication today is more frequently intertwined with science communication and technology studies (Hopke, 2024), as well as sustainability communication. Sustainability communication is a field of research focusing on

“the development of society at the core of which is a vision of sustainability. It is both about values and norms such as inter- and intragenerational justice and about research

into causes and awareness of problems as well as about the individual and societal possibilities to take action and influence development” (Godemann & Michelsen, 2011, p. 6).

In this work, the term environmental communication will refer to a broad scientific field covering studies from different disciplines on the role, development, influence, and techniques of communication concerning CC and other environmental issues.

A substantial body of literature has provided an overview of existent research within environmental communication from various perspectives. Specifically, they synthesized the historical development of environmental communication, documented trends and challenges, and proposed recommendations for future research. Moser (2010, p. 32) argued that “much of the early communication was relatively narrowly focused on scientific findings and synthesis reports.” By highlighting the historical development of CC communication theories and challenges, the researcher delineated key aspects of CC communication: purpose and scope of CC communication, key elements of the CC communication process, communication channels and forms (framing, messages, messengers, modes, and channels of communication), communication outcomes (Moser, 2010, 2016). At the same time, Ballantyne (2016, p. 337) identified the patterns in communication approaches to CC communication and argued that CC “communication research is detached from communication scholarship and has not attained the same level of consensus.” Thus, CC communication needs to apply the insights from general communication research to address communication challenges regarding CC and focus on the role of communication in engagement and learning about CC issues (Ballantyne, 2016). More recent work by Catellani et al. (2019) retraced the historical development of environmental communication focusing on French-speaking countries and defined several terms, e.g., sustainability, corporate social responsibility, and transition. This study highlighted the dynamism in the emerging field of environmental communication, yet with a certain lack of reflexivity and organizational structure (Catellani et al., 2019).

Much research has investigated CC communication via the press medium. Most of these works considered the text of the newspaper articles as an object of analysis. As such, McComas and Shanahan (1999) investigated the narratives about global warming from *The New York Times* and *The Washington Post*. Boykoff (2008) conducted a framing analysis of newspaper articles and a critical discourse analysis of interviews to study media representations of CC in the UK (Boykoff, 2008). Many researchers have further adapted the framing approach to

newspaper articles. They investigated 1) French and Dutch newspapers' coverage of the COPs (Dirikx & Gelders, 2010); 2) articles from the US newspapers including the keywords "climate change" and "global warming" (Hoffman, 2011); 3) press coverage of global warming in the USA and Sweden (Shehata & Hopmann, 2012); 4) CC-related articles from Peruvian newspapers from 2000 to 2010 (Takahashi & Meisner, 2013).

Discourse analysis is another frequently applied method to study CC communication, and it was applied to the articles from Indian newspapers (Billett, 2010). Kleinen-von Königslöw et al. (2019) conducted a content analysis of newspaper articles from five countries – Australia, Brazil, Germany, India, and the USA – regarding three COPs over ten years, i.e., the COPs in 2004, 2009, and 2014. More recent research employed a comprehensive dataset of 1,7 million online news articles to predict how media coverage of CC changes with temperature abnormalities (Pianta & Sisco, 2020). These works significantly contributed to the development of methods to investigate CC verbal communication in traditional media: content analysis, framing analysis, narrative analysis, and critical discourse analysis. These methods were further adapted to work with the visual data since visualizing CC and the environment is a significant step toward their understanding (Doyle et al., 2009).

The research on the visual aspect of CC from press media remained underdeveloped until the 1990s. One of the first works considering environmental images was conducted by Lutz and Collins (1993), who analyzed 598 images from the National Geographic magazine by applying content analysis. The images as part of stories about CC from newspapers were also the focus of the research of Dotson et al. (2012), who conducted a content analysis of articles from two Chilean newspapers. The study by O'Neil (2013) explored images from 13 newspapers in the USA, the UK, and Australia from a framing theory perspective. Later, Wozniak, Lück, and Wessler (2015) applied the theories of framing, narration, and visual representation to analyze newspaper articles about climate change in Germany, India, South Africa, and the USA. Another qualitative approach to analyzing the visuals about CC and its mitigation was suggested by Doyle (2011), who argued that various social and discursive practices can help the CC problem become more culturally meaningful. By conducting content analysis, more recent research on the visuals published by the *National Geographic* journal suggested that polar bears had been the most depicted animals in relation to CC from 1992 to 2012 ("Bearing Witness?," 2019), which, as was proved earlier, can make CC a distant problem (Doyle, 2011).

Alongside verbal or visual analysis of traditional media content about CC, the multimodal approach was particularly applied in linguistics. Dahl (2017, p. 28) combined textual and visual analyses of the articles about one of the IPCC reports from two UK newspapers, The Guardian and The Daily Mail, and highlighted the “specific challenge of visualizing climate change impacts and adaptation measures.” Another research identified and compared visual and verbal representations of the metaphors “*carbon footprint*,” “*fingerprint*,” and “*empreinte carbone*” in French and English newspaper articles (Augé, 2021b).

To extend the existing data-driven approaches, primarily focused on textual data, other scholars proposed different works on visual components of CC media coverage. For example, O’Neill (2013) combined content and framing analyses of the visual portrayal of CC in print media across the United States, the United Kingdom, and Australia throughout one year. This work demonstrated that “contested” and “distancing” visual frames remain prominent in the selected newspapers (S. O’Neill, 2013). Chadwick (2017, p. 10) synthesized the research related to CC imagery and emphasized the “need for more investigation of nontraditional mass communication channels as potential sources of public perceptions, locations for persuasion efforts, and ways for people to communicate about climate change.” Indeed, research on environmental communication on social media has been developing drastically since the early 2000s. In the next part, we will draw particular attention to the studies on environmental communication that emerged with the development of social media platforms.

1.2.2 Environmental communication on social media

The development of digital media allowed people to build communities focused on specific problems (Zatwarnicka-Madura et al., 2022). This encouraged scholars to investigate CC communication via new channels. In the last three decades, 21 definitions of social media appeared in communication research (Aichner et al., 2021). In this study, we follow the definition of social media as proposed by Kapoor et al. (2018, p. 536):

“Social media is made up of various user-driven platforms that facilitate diffusion of compelling content, dialogue creation, and communication to a broader audience. It is essentially a digital space created by the people and for the people, and it provides an environment that is conducive for interactions and networking to occur at different levels (for instance, personal, professional, business, marketing, political, and societal.”

A significant number of studies considered environmental verbal communication in digital media, e.g., online news platforms, websites, and social media, since they can involve a different logic of production and distribution of the content compared to traditional media (Hjarvard, 2018). Since the development of YouTube in 2005, Twitter (now X)⁶ in 2006, Instagram in 2010, and TikTok in 2016, the number of studies on digital communication about CC has significantly increased. We conducted a keyword search in the Scopus database and provided interesting statistics related to the number of academic articles regarding communication about CC on Twitter, YouTube, Instagram, and TikTok, focusing on our focus countries, Belgium, France, and Norway (Table 1).

Table 1 demonstrates that most academic literature focused on analyzing communication about CC on Twitter. 3039 academic articles in Scopus were dedicated to the “climat* AND chang* AND instagram” keyword search. Less works focused on communication about CC on Instagram in Belgium (N=118), France (N=338), and Norway (N=186). In the next paragraphs, we propose a review of the most significant works on environmental communication on different social media, excluding Instagram, since Section 1.2.3 is fully dedicated to the research on this social media.

Table 1 Number of articles including specific keywords in the Scopus database (01.02.2024)

	2010	2020	2024
climat* AND chang* AND communicat* AND social AND media	4471	46026	102797
climat* AND chang* AND twitter	35	6384	16929
climat* AND chang* AND youtube	126	6158	13555
climat* AND chang* AND instagram	0	537	3039
climat* AND chang* AND tiktok	0	13	733
climat* AND chang* AND instagram AND belgium	0	22	118
climat* AND chang* AND instagram AND france	0	58	338
climat* AND chang* AND instagram AND norway	0	34	186

Environmental communication on social networks has become an object of investigation with the active development and use of social media. Scientists have described the role of social

⁶ In this study, we use the name Twitter for this social media if the research on this platform was conducted before its name changing in July 2023.

media in creating and circulating messages about the environment and CC (A. Anderson, 2015; Holmes & Richardson, 2020; Wamsler et al., 2020). Salway (2017) briefly reviewed the techniques for automatic text analysis applied to CC discourse studies in news and social media. A number of studies were conducted on environmental communication disseminated on one of the following social networking platforms – Twitter, Facebook, YouTube, Instagram, or TikTok.

Even if YouTube is the oldest image-based social media on this list (Fung et al., 2019), most of the research on CC communication assesses Twitter data (See Table 1). The scholars investigated: 1) CC protests within the messages with #thewave and #cop15 hashtags (Segerberg & Bennett, 2011); 2) polarized frames in the USA, the UK, Canada, and Australia (Jang & Hart, 2015); 3) the themes and networks appearing with the messages related to #climatechange and #globalwarming hashtags (Veltri & Atanasova, 2017); 4) environmental campaigns, such as #plasticfreejuly (Heidbreder et al., 2021); 5) types of personalities that write about the environment on Twitter in the USA (Chang et al., 2022); 6) sentiments and topics in the messages of individuals and organizations about CC-related topics (Mouronte-López & Subirán, 2022); 7) trends in communicating CC in Belgium, France, and Norway (Pizarro Pedraza et al., 2022); 8) people's opinion on SDGs and barriers to more sustainable lifestyles (Singh et al., 2023); 9) sentiments and emotions within Twitter posts in English between 2010 and 2022 regarding vegan lifestyles (Shamoi et al., 2022). These example studies show how environmental communication research has evolved on Twitter, from analyzing keywords and constructing the networks of users to automated computational analyses, such as sentiment analysis or topic modeling.

Visual environmental communication transmitted through websites and digital media channels is a newly developing field compared to verbal communication about CC, and it is predominantly considered an area of qualitative research. The studies on visual aspects of CC communication on these mediums were mainly focused on small quantities of analyzed data from various perspectives of discourse analysis. For example, the videos of CC activist networks on YouTube were studied by Askanius and Uldam (2011) from a political discourse theory perspective. From a multimodal critical discourse analysis perspective, Hansen and Machin (2008) observed 600 images about the environment and CC shared via an image stock *Getty Images*. The authors focused on the multipurpose nature of the images by studying their generic meaning, meaning potential, settings, actions, and conceptual themes. Hopke and

Hesters (2018) evaluated images related to COP21 debates on Twitter by applying framing analysis. They randomly selected 200 visual tweets from a larger dataset, including 9,477 messages from Twitter. Mooseder et al. (2023) investigated visuals posted on Twitter from 2011 to 2021 under the #climatechange hashtag by applying novel machine-learning approaches. The researchers found that visualizations – for instance, memes, graphs, charts, maps, infographics, or posters – are the most common type of visuals on Twitter, which were significantly shared by the accounts of different stakeholders, in particular bots and scientific actors.

By studying the “skeptical” and “convinced” logic of the CC problem from a critical discourse analysis perspective, Ross and Rivers (2019, p. 992) argued that memes can represent “a powerful form of media communication.” One more study on memes identified recurring narratives of #climatechange hashtag content from TikTok (Hautea et al., 2021). Specifically, Hautea et al. (2021) analyzed the “multilayered form and rhetorical content” of 57 TikTok memes by conducting multimodal discourse analysis, which was presented by Rose (2016). Research by Al-Rawi and colleagues (2022) on Instagram and Facebook memes illustrated the connections between various themes related to COVID-19 and climate crises. The researchers drew particular attention to the common presence of problem-solution frames and increasing polarization around both issues. Recent research on TikTok videos posted about CC issues concerning the COP26 and the COP27 meetings demonstrated a high level of politicization in analyzed videos, mainly posted by influencers and media (Nieto-Sandoval & Ferré-Pavia, 2024).

More complex approaches combining several methods in communication research have been developed over the last ten years. They were both qualitatively and quantitatively oriented. For instance, Allgaier’s (2019) heuristic approach to qualitative thematic analysis of videos about CC from YouTube has shown how the more specific search terms about CC on YouTube, such as “*Climate Engineering*” or “*Climate Modification*,” can confront the viewers by challenging mainstream scientific position about CC. Moreover, the scholar highlighted YouTube’s role “for public science and environmental communication and for informing citizens about climate change and other science and research-based issues” (Allgaier, 2019, p. 10).

A rather quantitative approach to analyzing CC-related visuals from multiple social media platforms was attempted by Pearce et al. (2020), who introduced novel methods for

visual data analysis, such as image-text networks, image plots, and composite images. The researchers also highlighted the necessity “to look beyond single-platform research,” which will “enable researchers to take account of both the social phenomenon (social research) and platform effects (medium research)” (Pearce et al., 2020, p. 175). Another prominent study applying computational research methods to investigate CC visuals from Instagram and Twitter provided differences in platform use and popularity metrics in the two platforms (Qian et al., 2024).

1.2.3 Environmental Communication on Instagram

Instagram was released as a social media platform in 2010. The initial purpose of this social network was to share photos. With time, many functions were added to this platform (See Appendix 1 *Instagram Timeline*), such as video content, adding up to ten visuals to one post, live broadcasting, ephemeral stories that disappear in 24 hours but can be saved in specific highlights, and other functions. Today, Instagram represents an interactive multifunctional platform for individuals and organizations to communicate. An increasing amount of literature is devoted to the research on environmental communication, which was developed around the Instagram platform, with 3039 academic articles on Scopus (Table 1). The scholars investigated the content posted on this social media from different perspectives by applying different methodologies. These studies can be divided into three main categories: the studies of content posted on Instagram, the audience’s perceptions of the messages, and mixed approaches (See Figure 3). In the following paragraphs, we review the most prominent works and approaches to environmental communication on Instagram regarding the different groups of studies.

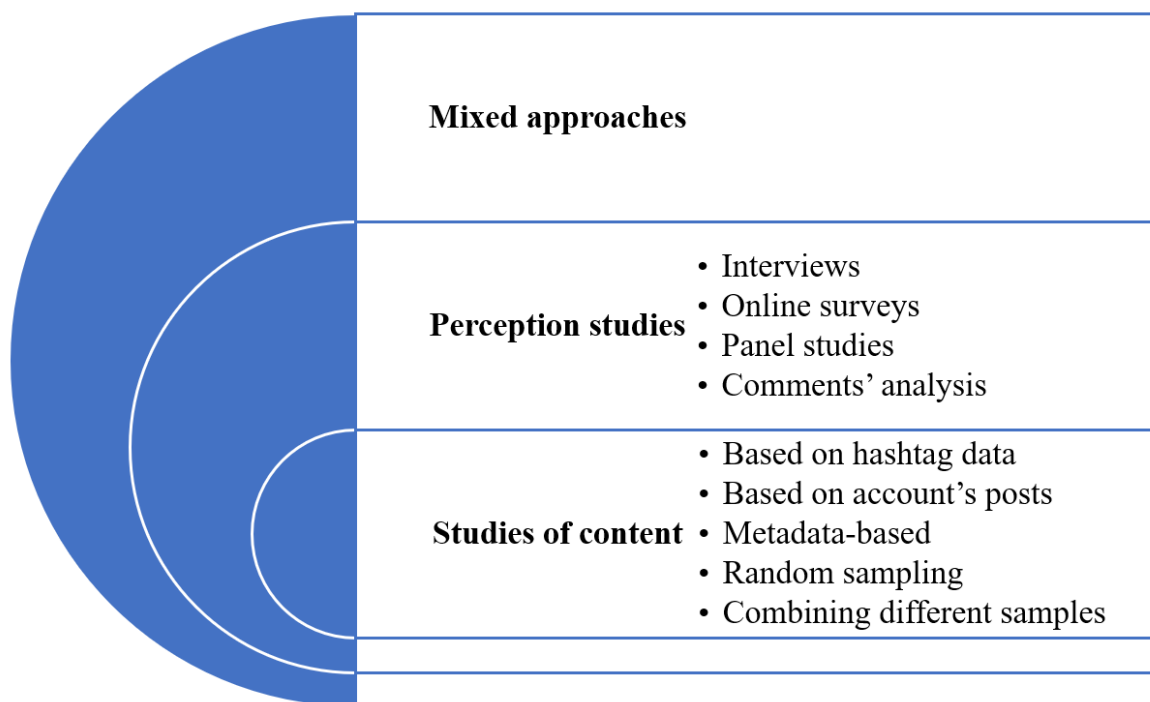


Figure 3 Groups of studies on environmental communication on Instagram

The studies of Instagram content related to CC and environmental issues can be hashtag-based, account-based, randomly sampled, or combining different methodologies to the corpus data. They investigated the content posted by global environmental movements (Herrmann et al., 2022) and their local branches in Belgium, France, and Italy (Samofalova et al., forthcoming; Samofalova & Marcella, 2023). The Instagram posts by environmental non-governmental organizations, such as Greenpeace, and specific campaigns, e.g., BringBackOurBottle campaign in Indonesia, were also in the scope of studies in Communication and Linguistics (Hartika et al., 2022; Lippert, 2022; Pramana et al., 2021). Hodson et al. (2018) observed the #climatechange hashtag community through computational analyses of the posts' texts, which helped identify climate-skeptical accounts behind the messages labeled as negative sentiments. Moret-Soler, Mateu, and Domínguez (2022) studied the discourse of cartoons related to four regions affected by wildfires, i.e., Amazonia, Australia, California, the Iberian Peninsula, which was shared on Instagram under #PrayForTheAmazon, #ActforAmazonas, #ArdeGalicia, #QueimanGalicia, #IncêndiosPortugal, #PrayForAustralia, or #CaliforniaFires hashtags.

In recent years, a branch of research on sustainable fashion communication on Instagram has developed from different perspectives. Lee and Weder (2021) analyzed thematic frames in the posts with the #Slowfashion hashtag in Australia. Greco et al. (2023) observed

argumentative patterns of sustainable fashion communication by studying posts with the #fashionrevolution hashtag.

In their pre-print, Schmid-Petri and Zehe (2024) discussed the frames within Instagram posts about the energy transition. With the help of quantitative content analysis, the authors identified different groups of actors who posted about the energy transition in January 2022, such as economic, political, and scientific actors, individual citizens, NGOs, and media. Amongst them, economic actors seemed to post more about the energy transition than others. While economic and scientific actors emphasized the benefits of solar energy in their posts, the NGOs, political actors, and individual citizens tended to post more about the disadvantages of traditional energy production. Most of the images analyzed from Instagram in this study included images representing new technologies and those with textual elements. In this work, Schmid-Petri and Zehe (2024) attempted to connect the framing analysis of the texts and analyses of individual images. However, their framing analysis focuses mainly on verbal data, opening new perspectives for visual media studies.

While the majority of the studies on environmental communication on Instagram are hashtag-based, San Cornelio, Martorell, and Ardèvol (2024) observed 60 Instagram accounts of influencers promoting sustainability. By identifying the narratives in posted content on Instagram and personal communicative strategies, the researchers proved that such influencers identify themselves primarily as eco-activists and assume that individual pro-environmental actions can largely contribute to climate change mitigation.

Many scholars incorporated different approaches to better contextualize specific issues related to CC debated. For example, Fine and Love-Nichols (2023) conducted a hashtag-based study of Instagram posts and comments about the pollution and destruction of the ecosystems during the COVID-19 pandemic containing the following hashtags: #WeAreTheVirus, #NatureIsHealing, and #CapitalismIsTheVirus. Milanesi et al. (2022) combined visual content analysis and the analysis of engagement metrics of the images posted by sustainable fashion companies such as Patagonia and Stella McCartney. Other researchers focused on strategies of sustainable brands related to Black Friday events in Instagram posts and surveys to evaluate these strategies (Sailer et al., 2022).

In the last five years, many scholars in environmental communication have investigated the role of environmental or green influencers on Instagram from different perspectives and demonstrated the rise in pro-environmental intentions of the followers of such influencers. For

example, DiRusso and Myrick (2021) conducted an online survey experiment to evaluate the emotional frames, such as hope, fear, and anger, and their efficacy in National Geographic's posts from Instagram regarding their campaign against plastic pollution. The researchers claimed that fear-framed messages can increase "participants' ability to form a mental representation" of a studied sustainability-related campaign (DiRusso & Myrick, 2021, p. 1057). Another online experiment affirmed the positive influence of green advertising on Instagram of a sustainable chocolate brand in Germany on followers of social media influencers as opposed to non-followers. The followers who cultivated a deep connection with such influencers perceived them as more trustworthy and evaluated the product more favorably (Breves & Liebers, 2022). A similar panel study effectuated in Austria by Dekoninck and Schmuck (2022) proved that following environmental influencers who advocate for sustainability and CC can foster a gradual enhancement in intentions toward pro-environmental behaviors over time, which is also linked to higher engagement in offline activities related to environmental issues. In addition to this, a more recent study based on interview data from Dutch and Belgian greenfluencers on Instagram confirmed that "shared enthusiasm for sustainability combined with a showcased relatable lifestyle fuel followers' perception of having a unique connection with the influencer" (Dekoninck et al., 2023, p. 711). In Chapter 2, we discuss the notions related to such influential individuals in detail.

Since the end of 2019, "the climate debate fell victim to the impact of the COVID-19 pandemic in the news media and the Twitter-sphere" (Rauchfleisch et al., 2021) and beyond these media channels. The research within the field has taken a new direction: comparing the politics and decisions behind the risks of two crises (Manzanedo & Manning, 2020) in order to provide recommendations for communication policies (Botzen et al., 2021). However, the pandemic has created new opportunities for climate communication by "generating a space for advocates of climate action to make connections between economic and environmental dimensions of sustainability" (Stoddart et al., 2021, p. 13). Thus, it has provided new insights into consciousness and global connectedness in environmental responsibility (Mocatta & Hawley, 2020) and the important role of individual and organizational online communication in crises (London & Matthews, 2022; Wukich et al., 2019). In the next section, we will discuss how individual and organizational communication about CC has developed on social media.

1.3 Communication of individuals and organizations on social media about CC-related issues

Individuals and organizations share their CC beliefs and values and promote environmental campaigns not only on traditional media, such as press and TV, but also on more novel, which have already become ordinary media sources, i.e., websites and social media. Communicating about environmental topics on social media creates awareness among the audiences on CC and sustainability (Pearce et al., 2019). While individual and organizational communication on social media is an established field of study, its branch related to environmental and CC communication is still developing. The difference between individual and organizational communication here lies within their entities. By studying the communication of individuals, we understand the research on a particular person who can be selected before or after data collection and whose communication represents a research object. Communication of organizations reflects the analysis of communication of a particular organization, which can be represented by a private company, non-governmental organization, or political organization. Considering the verbal and visual communication research, new multimodal aspects to studying environmental communication on social media were introduced in the last decade. In this section, we will draw particular attention to the most recent works that have contributed significantly to the development of this research field: from research on Twitter and YouTube to Instagram and TikTok studies.

Analyzing hashtag data from Twitter helped identify topics and communities posting about CC on Twitter. These communities are more likely to appear within a group of people sharing their opinions and views on CC, which are related to both supporters and opponents of the scientific facts behind the IPCC reports (Pearce et al., 2014). More recent research identified influential accounts that largely contributed to the discussions around COP21–COP26 on Twitter. The results showed a close connection between the increase in skeptical views about CC, the opposition to climate action, and problems related to institutional trust (Falkenberg et al., 2022).

Much research drew on the communication of well-known personalities, such as politicians, celebrities, or leaders of activist movements. Doyle, Farrel, and Goodman (2017) accentuated the significant role of celebrities, such as Leonardo DiCaprio, who represent the environmental beliefs of their audiences on the political stage. The researchers also argued that the emotional connection between the public and CC can be achieved through celebrities taking

the roles of CC journalists and documentarians. Moreover, celebrities' communication about environmental problems on social networks, such as Instagram, demonstrated an important role of verbal interaction on this predominantly visual social media platform (Deditius, 2020).

Climate movements, for instance, Fridays for Future and Extinction Rebellion, were in the scope of communication research (Belotti et al., 2022; Herrmann et al., 2022; Kavada & Specht, 2022; Nurfaizah & Harti, 2022; Sorce & Dumitrica, 2021). Investigating how the communication of activists and leaders of environmental movements is constructed on social media contributes significantly to understanding the movements' nature and structure and CC mitigation problems. For instance, Fernández-Prados et al. (2021) identified 38 teenage climate activists with Twitter or Instagram accounts in different countries and highlighted the feminine nature of climate activism with a significant role of Instagram in spreading information about CC.

On the one hand, the studies on environmental activism highlighted the difficulties in transmitting an environmental call for action, which can be related to the personal image of climate activists and the distance between them and their audiences. As such, a thematical analysis of some videos and social media posts with Vanessa Nakate, a climate activist from Uganda, has shown the barriers limiting her activism in the world arena: location, gender, and youth (Barnes, 2021).

On the other hand, understanding the framing of activists' messages can propose more effective forms of communication. The research of Molder et al. (2021) suggested that the moral and ethical framing of Greta Thunberg's communication can be an effective form of political communication and persuasion. They did so by linking framing theory to multimodal content analysis.

The research on CC communication of organizations on social media drew upon media use and discourse studies of climate activism, environmental NGOs, and private businesses. Greenpeace is probably one of the most frequently studied environmental NGOs. Its communication strategies and environmental campaigns on its website and social media were investigated using different approaches.

For example, Doyle (2007) focused on the media use of photography associated with various campaigns of Greenpeace in the early 1990s. The presented campaigns of Greenpeace made "environmental issues culturally meaningful and symbolically recognizable" (Doyle, 2007, p. 135). Another study analyzed the Greenpeace and Nestlé conflict, which escalated on

YouTube, about the sources of palm oil and Nestlé's contribution to forest destruction (Coombs, 2014). A more recent paper by Catellani (2022) investigated how Greimas' semiotics can be adapted to analyze recent environmental communication based on the example of Greenpeace's "L'emprise total" campaign in France. Overall, these studies represent a solid background for investigating Greenpeace's campaigns on social media.

Ji et al. (2018) explored how Greenpeace China framed its messages on Weibo and how its audiences reacted to them. The results of this work demonstrated that, on the one hand, the CC responsibility frame was related to more liked and commented posts. The conflict frame, on the other, motivated the audiences to join the debates and leave emotional comments. Pramana et al. (2021) attempted a rather visual approach to study a #ClimateCrisis campaign by Greenpeace Indonesia by combining symbolic convergence theory and fantasy theme analysis. This research revealed the threat caused by climate crisis impacts as a popular thematic frame in this campaign. This threat was pictured in the photos of sea level rises and floods. Another theme in this campaign was the switch to renewable energy sources, which was primarily visualized by the infographics. These visuals evoked an emotional response from the audiences. Other studies on Greenpeace's communication on social media covered their communication on the Facebook account of Greenpeace International (Katz-Kimchi & Manosevitch, 2015), YouTube in Indonesia (Kusumalestari, 2016), Instagram in Brazil (Furlan, 2020), Instagram in France, Belgium, and Canada (Samofalova, Catellani, & Cougnon, 2022).

A study combining the analysis of the CC visuals posted by individual activists, NGOs, the fossil fuel industry, and media organizations resulted in the identification of 12 climate frames of the COP21 discussions on Twitter. They were nation-state contributions, procedural outcomes, non-treaty, clean energy and efficiency, fossil fuel-based, nuclear, personal behavioral change, climate justice, transparency, climate science, no climate solution, and not applicable. For organizations and individual activists, climate justice was a prevalent visual frame on Twitter. Indeed, fossil fuel companies tended to post the visuals framed as nation-state contributions to international debates about climate policies (Hopke & Hestres, 2018).

Public interaction of environmental NGOs on social media can be studied by analyzing three types of data, i.e., user profiles, posts, and comments to the posts. As shown by the example of Facebook communication of the National Oceanic and Atmospheric Administration, "accurate information about the causes and consequences of climate change can have important real-world impacts" on audiences' behavior (N. M. Lee et al., 2018, p. 282).

Other types of stakeholders involved in CC online discourse are the companies that adapt their products and services according to SDGs. Much research in marketing communication has taken this direction in recent years. Scholars observed how “green” and sustainability communication is constructed on social media pages of cosmetics (Kenalemang-Palm & Eriksson, 2021), fashion (Kwon & Lee, 2021; E. Lee & Weder, 2021; Milanesi et al., 2022), food (Šikić, 2021), transport (Kasianova, 2021) and fossil fuel (Sagapova et al., 2022) companies.

To conclude, studying the communication of individuals and organizations about CC issues on social media is a phenomenon that is developing in many directions. It covers such aspects as organizational communication, self-presentation as environmental actors, specific environmental campaigns, and responses from the audiences. Our literature analysis demonstrates that scholars prevail single-platform research on communication of individuals and organizations. Twitter, Facebook, Instagram, and YouTube are primarily used social media for such single-platform research. Less research exists on a more recent social media platform, TikTok. While some researchers highlighted the necessity of developing cross-platform studies, this field remains significantly underdeveloped, considering the communication of particular individuals and organizations.

Most of the presented studies confirmed the vital role of images and videos in visualizing CC causes and impacts. These visuals become symbols of CC and make it meaningful for different audiences. Together, visuals and texts posted on social media influence our understanding of the problem and should be carefully prepared. In line with this, we suggest that more research should be done by combining visual and verbal modes of social media communication about CC concerning different types of enunciators. Finally, we believe this thesis will significantly contribute to the understanding of multimodal communication regarding CC mitigation on Instagram.

Chapter 1: Key definitions

- CC is “a change in the state of the climate that can be identified (e.g., using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. It refers to any change in climate over time, whether due to natural variability or as a result of human activity” (IPCC, 2012, p. 956).

- **CC mitigation** is “limiting carbon-intensive technologies, processes, and practices and developing and adopting clean technologies” (Constantino et al., 2021, p. 34).
- **Sustainable development** is a complex approach to balance economic growth, social equity, and environmental protection, aiming to improve the quality of life while preserving the integrity of the environment (Servaes & Lie, 2015).
- **Sustainability transition** is the transition from high- to low-carbon lifestyles (IPCC, 2022b).
- The terms “**obstacle**” and “**barrier**” are interconnected in this work and are used as synonyms to describe the challenges that restrain or complicate the efforts to reduce greenhouse gas emissions and mitigate the effects of CC.
- **The food sector** related to the sustainability transition covers the impacts of CC on agriculture, animal and livestock health and productivity, sustainable aquaculture production and fisheries regulation, food security, and agroforestry. The main recommendations for CC mitigation in this sector include developing agroecology, decreasing food waste, changing dietary behavior by reducing meat and dairy consumption, and buying local, seasonal food (IPCC, 2022a).
- **The transport sector** is defined by the sustainability transition practices regarding different motorized and non-motorized modes of transport. It requires encouraging walkable cities and non-motorized transport, development of public transport infrastructures, expansion of electric vehicles, use of energy-efficient appliances, and share of other low-carbon fuels, i.e., hydrogen and biofuels (IPCC, 2022a)
- **The energy sector** is represented by the sustainability transition practices concerning different energy sources, e.g., fossil fuels, gas, wind, solar energies, etc. It incorporates the development of resilient power systems, energy reliability, energy diversification by renewable energy sources, such as wind, solar, or hydroelectric, and the necessity of improving energy efficiency and storage (IPCC, 2022a),
- **Environmental communication** is a broad scientific field covering studies from different disciplines on the role, development, influence, and techniques of communication concerning CC and other environmental issues.
- **Social media** is “various user-driven platforms that facilitate diffusion of compelling content, dialogue creation, and communication to a broader audience. It is essentially a digital space created by the people and for the people, and it provides an environment that is conducive for interactions and networking to occur at different levels (for instance, personal, professional, business, marketing, political, and societal” (Kapoor et al., 2018, p. 536).

Chapter 2 Environmental opinion leaders

This chapter addresses the notions related to opinion leadership: influencer, opinion leader, and opinion-leading organization. By synthesizing the research on media sociology, marketing, communication, and psychology, we propose definitions of environmental opinion leaders and environmental opinion-leading organizations and the methods of their identification.

2.1 Opinion leadership: opinion leaders, opinion-leading organizations, influencers

Opinion leadership has been studied from various perspectives. It developed from media sociology in the 1990s and was further introduced in psychology, communication, marketing, and political studies. Opinion leadership was first defined as a two-step flow communication model (Katz & Lazarsfeld, 1955), where opinion leaders position themselves between media and their audiences. Later, Watts and Dodds (2007) argued that opinion leadership can flow in any direction.

As defined by Rogers (1983, p. 271), opinion leadership is the “degree to which an individual is able informally to influence other individuals’ attitudes or overt behavior in a desired way with relative frequency.” Opinion leaders are more likely to support innovative changes in norms within different social systems. Moreover, they are more likely to share similar attitudes, beliefs, education, or social status with the leader since this similarity makes the personal relevance (E. M. Rogers, 1983).

One of the first definitions of opinion leaders in media sociology and mass communication research was proposed by Berelson and Steiner. According to the researchers, OLs are

“those trusted and informed people who exist in virtually all primary groups, who are the ‘models’ for opinion within their group, who listen and read in the media, and who then pass on information and influence to their circle of relatives, friends and acquaintances” (Berelson & Steiner, 1964, p. 550).

Berelson and Steiner (1964, p. 570) also claimed that OLs are “a little better educated” than other members of their group of influence. With the development of media technologies, this definition became less convincing and many researchers attempted to augment it. For instance, by identifying OLs for the movie industry, Venkatraman (1989, p. 53) defined opinion leadership as “an interpersonal communication and influence phenomenon,” which must be investigated in the context of its network of social and communication relationships. More

importantly, OLs, compared to other people, according to Venkatraman (1989), possess a better education, a higher status and social ranking, and the potential to influence others. Thus, they “perform specific social functions” (Zatwarnicka-Madura et al., 2022, p. 4). In addition, other authors relate the influence on purchasing behavior to the characteristics of opinion leaders (Flynn et al., 1996).

Recent definitions of opinion leaders draw particular attention to the diffusion of information. Amongst presenting oneself in a positive light and persuading others, information processing and its dissemination remain crucial goals for opinion leaders (Chwialkowska, 2019; Turcotte et al., 2015; Winter & Neubaum, 2016). Furthermore, OLs possess a certain level of expertise in a specific area and the strategic know-how to utilize social networks to their advantage. OLs are connected with individuals within and outside their social circles and can be characterized by popularity and competency (El Barachi et al., 2021).

Wang and Li (2016) distinguished two types of opinion leaders: traditional OLs and virtual OLs. They differ in the medium of interaction with their audiences. Specifically, virtual OLs communicate largely online with their audiences. In this case, communication has two purposes: self-involvement and online interaction (Y. Wang & Li, 2016). While self-involvement is related to the personal characteristics of OLs, such as the level of expertise in a particular subject, online interaction means a strong interest in interacting with others through social media platforms (Wolny & Mueller, 2013). This “electronic word-of-mouth is the dominant mechanism of information exchange for strengthening adoption intentions” of digital innovations regarding CC, such as electric vehicles or smart-home technologies (Vrain et al., 2022).

According to Wang and Li (2016, p. 117), “opinion leaders can also be organizations” since the patterns of opinion leadership remain among organizations. Such opinion-leading organizations lead the adoption of innovation through organizational networks. Composed of interpersonal relationships, opinion-leading organizations exert influence not only on follower organizations but also on individuals. This provides an effective message dissemination strategy among their social sectors (Dearing, 2008).

With the development of the research on social media, a new term entered marketing and communication disciplines – influencer. Litterio et al. (2017, p. 351) defined influencers as “those individuals located in a position within the online social network from which they could potentially achieve greater outreach of the diffusion of the message deriving out of their

connection structure.” In this definition, the authors suggest a close link between influential individuals, their audiences, and the desire to expand these audiences in order to share their messages. The definition suggested by Abidin (2015) expanded the characteristics of influencers by their desire to monetize their account. Specifically, the author wrote:

“influencers are everyday, ordinary Internet users who accumulate a relatively large following on blogs and social media through the textual and visual narration of their personal lives and lifestyles, engage with their following in digital and physical spaces, and monetize their following by integrating “advertorials” into their blog or social media posts.”

In their more recent study, Beckert and Koch (2022) share Abidin’s ideas; according to them, influencers represent a form of “microcelebrity” who impacts their followers’ opinion formation and purchase decisions. Indeed, the income from online activities becomes a specific characteristic of influencers, defined by Hund (2023, p. 29) as “people who earn income as independent workers providing ‘authentically’ curated content to carefully cultivated online audiences.” These individuals are represented by a very diverse range of specialists, including experts in different fields, activists, artists, idols or celebrities, and others. These personalities influence and shape other people’s viewpoints and build “lasting relationships with many recipients who identify with them very strongly” (Zatwarnicka-Madura et al., 2022, p. 3).

In addition, influencers can be characterized by their desire to monetize their accounts on social media (Abidin, 2015; Hund, 2023), i.e., obtain financial profits for posting sponsored content. This monetization of social media accounts can lead to developing a professional career on social media, which is particularly developed through authentic activities. In general, the idea of authenticity can be described as “the feeling and practice of being true to one’s self or others” (Vannini & Franzese, 2008, p. 1621). In marketing, authenticity is purposefully constructed (A. L. Zhang & Lu, 2023) and refers to the extent to which followers perceive a social media post, including the advertisement of a product or brand, in a manner that resembles reality (Miller, 2015; Pöyry et al., 2021).

Regarding similar grounds in opinion leadership, OLs and influencers are sometimes equated within marketing research (Flynn et al., 1996). By contrast, a large number of academic literature provides distinctions between them (De Veirman et al., 2017; Martínez-Sala et al., 2019; Vernet & Giannelloni, 2009; Zatwarnicka-Madura et al., 2022). Within the research on social media, both OLs and influencers have a certain level of opinion leadership: they are

considered credible experts on their topics of interest, have a certain number of followers, and produce a particular impact on their communities. However, they should be distinguished by their desire to monetize their accounts as influencers integrate sponsored content on their social media accounts and impact their followers' opinion formation and purchase decisions.

In this work, we opt for the term opinion leader, because the object of analysis is multimodal posts, more or less spontaneously created without the aim to profit from sponsored content financially. This will help us not consider the limitations within the algorithms of sponsored posts on social media.

2.2 Opinion-leading and influential individuals in environmental communication

As OLs can be seen as innovative people regarding the changes within the social system's norms (E. M. Rogers, 1983), their role in the adaptation of CC mitigation strategies is incontestable: they can diffuse information about CC and sustainability and motivate a behavioral change of their audiences (Keys et al., 2010). These social influences can be seen as more effective than information campaigns to promote sustainable consumption since their effects may complement environmental values, motivate pro-environmental actions (Lazaric et al., 2020), and contribute to low- and high-effort activism (Knupfer et al., 2023).

Six categories of self-identified OLs in climate change issues were presented by Nisbet and Kotcher (2009): 1) issue-specific OLs, 2) OLs by their personality strengths, 3) Roper ASW's⁷ influentials based on people's political and social activity, 4) product- or behavior-specific OLs, 5) communicative early adopters, 6) market-mavens. Issue-specific and behavior-specific OLs are more relevant categories to our project since they are involved with a particular topic related to CC, obtain better media attention, and promote environmentally friendly behaviors and lifestyles.

OLs promote the transmission of information about sustainability via in-person and social media communication. OLs in citizen science are defined as individuals who

“ (1) seek citizen science opportunities because they are interested in one or more environmental issues; (2) gain a certain level of expertise through participation in

⁷ Roper ASW is an American organisation for public opinion research, <https://ropercenter.cornell.edu/roper-organization>

citizen science projects, and (3) pass on their skills and knowledge to other individuals within their social network” (M. F. Johnson et al., 2014, p. 243).

These OLs on social media can be stakeholders from different fields: political leaders, scientists, economic actors, activists, organizations, and others.

Alongside the notions of OLs and influencers, there has been a remarkable rise in influencers specializing in sustainable lifestyles and protecting the environment (Phua et al., 2020). Recent studies provided a solid theoretical background on social media influencers in environmental communication and emphasized the necessity to analyze the content shared by these individuals (Dekoninck & Schmuck, 2022; Schmuck, 2021). Other works on analyzing social media posts about climate change, environment, or sustainability issues proposed various names for these influencers: *climate-change influencers* (Ballestar et al., 2022), *eco-influencers* (Bentley et al., 2021; Huber et al., 2022), *greenfluencers* (Sailer et al., 2022), *sustainability influencers* (Chwialkowska, 2019), or *CC opinion leaders* (Samofalova, 2024). Although these notions seem very similar, they are differentiated by the scholars in communication research.

In Table 2, we provide seven different options that can be found in academic literature referring to environmentally conscious influencing actors. For example, *environmental OLs* “have a high concern for wildlife conservation issues and willingness to expend personal resources in order to gain expertise. They are more likely than the average citizen to utilize their own time and resources to gain expertise concerning particular issues” (M. F. Johnson et al., 2014, p. 237). These individuals are interested in environmental issues, possess a certain level of expertise, and transmit their knowledge to other individuals. *Climate change OLs*, compared to environmental OLs, is a broader term to describe individuals who “not only draw attention to climate change-related problems but also signal how others should respond or behave to reduce high consumption lifestyles” (Samofalova, 2024, p. 7). A definition of *digital climate change influencers* by Ballestar et al. (2022) is close to the environmental and climate change OLs since their main activity is communicating about climate-related themes and sustainable strategies and drawing attention to climate change-related events.

The other terms of influential individuals may or may not include the main component of influencers – monetization of the accounts. For instance, Schorn et al. (2022) directly emphasized the commercial nature of influencers’ communication, which aims to demonstrate new behaviors, although not only related to the sustainability field. Other definitions indirectly imply the monetization of the accounts of influential individuals by highlighting the desire to

promote “sustainability, vegan, clean living, zero trash, and reusable goods content” as from the definition of *eco-influencers* by Bentley et al. (2021, p. 206).

Table 2 Notions of opinion-leading and influential individuals in environmental communication research

Notion	Definitions from recent studies	Main activities on social media
<i>Digital climate-change influencer</i>	Influencers who can be “agitators” sparking discussions on and attention to climate change-related events, and “synthesisers” compiling and communicating about the news and strategies (Ballestar et al., 2022, p. 2274).	communicate about CC-related themes and sustainable strategies, draw attention to CC-related events
<i>Eco-influencer</i>	(1) Influencers communicating about environmental topics, providing orientation, and raising awareness and interest in environmental topics (Huber et al., 2022) (2) Influencers creating “sustainability, vegan, clean living, zero trash, and reusable goods content” (Bentley et al., 2021, p. 206)	promote pro-environmental behavior, mobilize people, collaborate with organizations, create sustainability-related content
<i>Environmental opinion leader</i>	Individuals who “have a high concern for wildlife conservation issues and willingness to expend personal resources in order to gain expertise. They are more likely than the average citizen to utilize their own time and resources to gain expertise concerning particular issues” (M. F. Johnson et al., 2014, p. 237)	seek citizen science opportunities, participate in citizen science projects, and transmit their skills and knowledge to other individuals within their social network
<i>Climate change opinion leader</i>	“Engaged and competent individuals, who not only draw attention to climate change-related problems but also signal how others should respond or behave to reduce high consumption lifestyles” (Samofalova, 2024, p. 7)	promote pro-environmental behavior, mobilize people, inform about CC issues
<i>Greenfluencer</i>	(1) “subset of specialized influencers [...] who promote a sustainable lifestyle and eco-consciousness” (Pittman & Abell, 2021, p. 1) (2) “content creators who educate and inform about environmental issues and often market green products” (Sailer et al., 2022, p. 8) (3) celebrities and influencers “campaigning for pro-environmental behavior” (Boerman et al., 2022, p. 921) (4) “a subgroup of influencers who specifically post content related to sustainability”	promote sustainable lifestyles, i.e., render the green claims made by the brands they endorse more trustworthy, promote sustainable products
<i>Sinnfluencer</i>	“commercial influencers who have reconsidered their lifestyle and want to use their reach in a meaningful way” translated by Schorn et al. (2022) from the German definition by Benecke (2019)	communicate about different topics, e.g., politics, sustainable fashion, veganism, sustainable traveling; demonstrate new behaviors
<i>Sustainability influencer</i>	“green lifestyle advocate” (Chwialkowska, 2019, p. 33)	advocate sustainability

Over the past decade, several definitions of *greenfluencers* have appeared in academic literature (Table 2). Greenfluencers can be content creators (Sailer et al., 2022), celebrities and influencers (Boerman et al., 2022), or subgroups of influencers (Pittman & Abell, 2021). Besides the information and education about sustainability issues transmitted by greenfluencers (Sailer et al., 2022), they largely promote sustainable lifestyles (Knupfer et al., 2023; Pittman & Abell, 2021) or pro-environmental behaviors (Boerman et al., 2022) such as consumption of green products (Sailer et al., 2022).

In addition to promoting green, sustainable lifestyles, such influential individuals may, on the one hand, be differentiated by their desire to advocate for climate, as *sustainability influencers* identified by Chwialkowska (2019). On the other hand, *greenfluencers* contribute to raising awareness about the climate crisis by promoting environmental activism (Knupfer et al., 2023). The definition of greenfluencers can be seen as an expanded version of sustainability influencers since they not only publicly support the idea of sustainable development but also promote and educate about sustainable lifestyles and eco-consciousness and promote green products (Pittman & Abell, 2021; Sailer et al., 2022).

As illustrated in Table 2, all definitions of these influential individuals can be referred to as a “subset of specialized influencers” (Pittman & Abell, 2021, p. 1), whose role is to communicate about CC-related issues and to promote sustainable lifestyles. Building on this line of research, the definitions entailing the concept of influencer emphasize the commercial side of their activities, which is clearly seen in the definition by Sailer et al. (2022), where the authors draw attention to the marketing of green, in other words sustainable, products. These influential individuals on social media post about various issues to promote sustainable lifestyles: sustainable fashion, slow traveling, waste reduction, vegan lifestyle, or environmental activism. Moreover, they tend to achieve an increased trust level from their audiences (Pittman & Abell, 2021). A cross-sectional survey conducted on young people (16–25 years old) in Germany indicated a high potential for greenfluencers to influence youth environmental activism positively (Knupfer et al., 2023). Another essential aspect of opinion-leading and influential individuals is people’s mobilization, highlighted in the definitions by Huber et al. (2022) and Samofalova (2024). To mobilize their communities to take collective actions, eco influencers use “a wide array of different visual elements,” such as visual narratives in TikTok videos (Huber et al., 2022, p. 718).

Previous theories of opinion leadership emphasized a central role of OLs: between the media and the followers. A more recent study based on social media data from Twitter proved that OLs “may no longer need to rely on information provided by the media if they have access to first-hand information.” Furthermore, they are directly involved in the CC and receive more attention from their audiences (Walter & Brüggemann, 2018).

The study of Wang *et al.* (2021) confirmed the significant role of opinion leadership in the diffusion of information about innovations contributing to sustainable development – eco-innovation. The OLs, in this case, possess two roles: role models and gatekeepers. As people with more knowledge about eco-innovations, OLs are role models for their followers, who seek information about such innovations from OLs. This knowledge possession about eco-innovations gives OLs the privilege “to polish and translate the knowledge for other community members, or to distort or block information if they decided” (Y. F. Wang et al., 2021). Hence, identifying the gaps and bridges of this communication can be meaningful for further research.

In the scale of the present project, we adapt the definition proposed by Samofalova (2024) yet emphasize their relations to the environment and, therefore, call them environmental OLs. Environmental OLs here are engaged and competent individuals, i.e., they have a certain level of expertise in sustainability and environment-related issues, critically evaluate and address the issues related to CC mitigation problems, and signal how others should respond or behave to reduce high consumption lifestyles. We suggest that applying the definition of environmental OLs can, on the one hand, broaden the range of accounts selected for the analysis. In this context, environmental OLs can be politicians, media personalities, environmental and climate activists, and influencers in different spheres who publish their messages on climate change mitigation. On the other hand, we attempt to reduce the bias related to the monetization of the accounts by greenfluencers and the influence of sponsored content on environmental communication, which should be separately analyzed by marketing research.

Since the accounts of individual OLs “are most likely to publish adoptive/supportive behaviors” and organizational OLs tend to post “descriptive and injunctive normative messages” (Y. Wang & Li, 2016, p. 127), we suggest that analyzing the data from the accounts of environmental opinion-leading organizations (OLOs) can provide a different view on the obstacles and barriers to pro-environmental action. In this context, we define environmental OLOs as organizations that have a solid reference for environmental issues in their corporate DNA and are involved in the dissemination of environmental and climate change-related

information by drawing particular attention to proposing solutions for how others should react to contribute to climate change mitigation strategies.

2.3 Opinion leaders and organizations: how to identify

By reviewing scientific literature on the topic, Bamakan (2019) identified six approaches to detecting OLs: descriptive, diffusion process-based, statistical and stochastic, topological measures, data mining, and hybrid content mining. The descriptive approach is related to traditional methods of measuring opinion leadership. They comprise sociometric methods, key informants, and self-designating. Sociometric methods use interviews, questionnaires, and surveys to ask all group members to identify OLs. Similar to this method, key informants can be chosen to be interviewed to provide information about opinion leaders. Finally, one can identify OL by their self-identification as OL (E. M. Rogers & Cartano, 1962). Providing exemplary publications, we will delineate the specifics of each method in the following paragraphs.

One of the first methods developed in the 1970s was applied to identify OLs based on their self-identification. Corey interviewed 755 respondents from the automobile sector and 299 respondents from the food sector by telephone to investigate whether these participants identified themselves as OLs. This method helped determine the potential segments for new product development and reach new audiences. A more recent adaptation of this method can be seen in the work of Vraga et al. (2015), where questionnaire data measured peoples' engagement with energy and climate issues. Alongside evaluating their social media practices, the participants were asked to rate their perceptions of themselves as an important source of information for other people about the selected target topics and to suggest other people who could be named as influential in this domain. This method provided issue-specific data to understand users' engagement and opinion leadership on Facebook. However, its main drawback lies in a high degree of error while applying this method: some participants may classify themselves incorrectly as OLs (Corey, 1971).

In marketing research, opinion leadership can also be measured by survey data. The opinion leadership and opinion-seeking scales proposed by Flynn are based on questionnaires distributed to potential consumers and audiences. Containing 19 questions, these scales can be used to identify the effects of opinion leadership on the adoption of products (Flynn et al., 1996). The main feature of a survey is its focus on a particular target group.

More recent methods of identifying OLs include building connections networks from existing corpus on a particular subject (Dubois & Gaffney, 2014) and measuring the number of followers and how far their messages travel (Wu et al., 2011). According to Litterio (2017, p. 347), such account's engagement metrics as shares and comments indicate a high level of user engagement with the content, yet the likes are considered as "low weighting" and contribute to the "electronic word of mouth." The identification of OLs using this method can be computer-assisted or manual. For example, Walter and Brüggemann (2018) obtained geo-located Twitter data, whose network analysis, with the help of R packages, enabled researchers to identify OLs attending the COP21 summit. Nevertheless, this method can be limited since not all Twitter users apply the geo-location function when posting a message (Walter & Brüggemann, 2018).

A mainly manual identification of sustainability influencers is presented in the work by Chwialkowska (2019). The researcher identified hundreds of social media pages of green lifestyle influencers through Google search, and then a two-step filtering was applied to narrow down the obtained data and "maximize the utility" of the data (Chwialkowska, 2019, p. 35). The first step included such criteria as (1) the same communication language – English, (2) public pages only, (3) allowance of the comments, (3) the page should not be an online store, (4) the page should not be a paper magazine, (4) no or few commercial purposes, (5) the page is not administered by an anonymous person, (6) activity of the page. The second step of filtering the selected pages of green influencers included the accounts' validation through five criteria such as (1) presence on at least three social media platforms, (2) minimum of 10000 likes or followers regarding the platform affordances, (3) 2% account's engagement, (4) minimum three years of account's existence, (5) representing specific thematic areas, e.g., beauty, health, food (Chwialkowska, 2019, p. 35).

The main steps for network analysis to identify OLs include (1) keywords selection according to the theme of the research; (2) collection of the data from social media containing the keywords within a selected period; (3) network analysis of mentioned accounts in the posts with the help of computational tools, for example, Gephi; (4) identification of the clusters of influential accounts and the connections between them. The conversations can not fully complete the discursive environment and are limited by one platform only. The network can be changed over time.

Another form of network analysis can include talk and social media centralities: the participants are asked to list the names of anyone they had talked to about a particular issue and

to indicate from whom they received information about the issue. This information is further processed to calculate 2-step reach and betweenness centrality measures in conformity with the connections among participants in each network. The 2-step centrality in this work “indicates how many nodes a given node can reach in two or fewer steps” and implies that influential individuals are those “who reached out to many people within two connections [...] and those who were nominated as information sources by many participants” (Y. F. Wang et al., 2021, pp. 3–4). Betweenness centrality “represents the extent to which an individual serves as a potential “go-between” for other pairs of nodes in the network by occupying an intermediary position of the shortest paths connecting other nodes” (Y. F. Wang et al., 2021, p. 3). Both measures are calculated using mathematical formulas.

More novel approaches to detecting OLs appeared in computational sciences (C. Li et al., 2019). A whale optimization algorithm is a computational method that can be used to detect top-N OLs on social media. It computes the objective function for each user using their distance and centrality, determines the communities in the dataset, and estimates the top 10 OLs within local and global contexts (Jain et al., 2020). This algorithm has shown high efficiency in detecting OLs; however, its usage demands advanced programming skills and, therefore, is unavailable to many researchers.

Some studies on detecting opinion-leading accounts from online communities use a combination of several methods. Y. Li et al. (2013) suggested applying a three-factor automatic identification based on textual content, user behavior, and temporal factors. Johnson et al. (2014) integrated survey data, interviews, and focus groups to identify environmental OLs. In combination with interviews, Twitter data were successfully applied by Boatwright (2022) to identify OLs around anthem protests.

To summarize, research within social sciences proposes various methods for identifying OLs, from qualitative surveys and interviews to more quantitative network analyses. Surveys and interviews are primarily used to investigate marketing campaigns in different spheres. Their main limitation is the time required for data collection and further analysis. More rapid methods to identify OLs include various types of network analyses from social media data. They are constructed with the help of computational methods and can determine the connections between particular accounts and potential clusters of OLs. However, these methods are accessible to users with advanced programming skills. Considering the advantages and drawbacks of each method, we manually selected environmental OLs and OLOs from social media for this

research. The criteria for the selection are adapted from the definition of environmental OLs and OLOs (cf. Section 2.2) and are presented in Section 4.2.1.1 *Criteria of opinion leadership on social media*.

Chapter 2: Key definitions

- **Opinion leaders** are trusted and informed individuals or organizations possessing higher status and social ranking, having a certain level of expertise in a specific area and the strategic know-how to utilize social networks to their advantage, and having the potential to influence others by spreading information or being role models (1964, p. 550; Chwialkowska, 2019; El Barachi et al., 2021; Turcotte et al., 2015; Venkatraman, 1989; Y. Wang & Li, 2016).
- **Influencers** are “everyday, ordinary Internet users who accumulate a relatively large following on blogs and social media through the textual and visual narration of their personal lives and lifestyles, engage with their following in digital and physical spaces, and monetize their following by integrating “advertorials” into their blog or social media posts” (Abidin, 2015).
- **Environmental OLs** are engaged and competent individuals, i.e., they have a certain level of expertise in sustainability and environment-related issues, critically evaluate and address the issues related to CC mitigation problems, and signal how others should respond or behave to reduce high consumption lifestyles.
- **Environmental OLOs** here are engaged and competent organizations that possess expertise in sustainability and environment-related issues, critically evaluate and address the issues related to CC mitigation problems, and signal how others should respond or behave to reduce high consumption lifestyles.

Chapter 3 Multimodal communication and social media

Social media provides “easy and convenient access to large quantities of data” on any imagined topic, including visual content such as images, videos, and gifs (Nau et al., 2022, p. 21). The research on images from social media has been rapidly developing since the early 2000s (Fung et al., 2019). Indeed, many studies have focused on analyzing images from Flickr, Twitter, or Instagram (Samani et al., 2018; Trillò et al., 2021). Concurrently, several other studies investigated the videos from YouTube (Allgaier, 2019; Waters & Jones, 2011) and TikTok (Hase et al., 2022; Matamoros-Fernández et al., 2022). These works contributed to the development of visual methodologies and social media studies by addressing theoretical and methodological issues. Moreover, they drew attention to the necessity of developing a multimodal approach to online data (Berger, 2015). In this chapter, we put forward more recent methodological approaches to investigate multimodal data from social media platforms. We start with the concept of multimodality (Section 3.1). Then, we discuss various research methods that could be applied to multimodal data from social media (Section 3.2). We conclude this chapter with some prominent studies that successfully applied mixed-methods research designs (Section 3.3).

3.1 Multimodality as a concept

We live and communicate in a multimodal world: Our interactions can simultaneously include speech, gaze, gestures, music, texts or captures, and videos. All of them constitute different modes of communication. By mode, Kress (2010, p. 79) understands a semiotic resource for meaning-making that is “socially shaped and culturally given.” More broadly, multimodality can be defined as “representations in many modes” (Kress, 2010, p. 22).

Multimodality is a concept developed in semiotics by different schools. Barreneche (2023) summarized the authors of Argentinian, Brazilian, English-speaking, French, and Italian approaches to semiotics (Figure 4). In this study, we combine the concept of multimodality from the French school of semiotics, which follows a structuralist approach to the meaning-making of different discursive modes, and the English or Anglo-Saxon approach in social semiotics developed from Halliday’s functional linguistics.

Account	Author	Text	Date
Argentinean	Eliseo Verón	<i>La semiósis social</i> (book)	1988
Brazilian	Centro de Pesquisas Sociosemióticas	Texts "Quem somos" [Who are we] and "Sobre o CPS" [About CPS] on the institutional website	n/a
English-speaking	Robert Hodge & Gunther Kress	<i>Social semiotics</i> (book)	1988
English-speaking	Theo van Leeuwen	<i>Introducing social semiotics</i> (book)	2005
French	Eric Landowski	"Les chantiers sociaux de la sémiotique" (article)	1984
French	Eric Landowski	Point 10 of entry "Sociosemiotics" in Greimas and Courtés' Dictionary, second volume	1986
French	Eric Landowski	"Sociosemiótica: uma teoria geral do sentido" (article)	2014
French	Jean-Marie Floch	<i>Sémiotique, marketing et communication</i> (book)	1990
French	Jacques Fontanille	<i>Pratiques sémiotiques</i> (book)	2008
Italian	Gianfranco Marrone	<i>Corpi sociali</i> (book)	2001

Figure 4 Different approaches to social semiotics and multimodality. Source: Berreneche (2023).

The French school of semiotics adopted a rather structuralist approach developed by Barthes (1967), which addresses multimodal signs within cultural and social contexts by considering their denotation and connotation. This approach was further adopted by marketing research (Floch, 2002, 2010) and communication studies (Joly & Martin, 2015, 2021). Another approach developed by French scholars includes digital multimodality incorporating audio, video, geolocalisation, temporality, dynamics, verbo-oral expression, postures, gestures, and graphic icons (Amoyal et al., 2022). The last can refer to the digital discourse analysis proposed by Paveau (2017).

A social semiotic approach to multimodality adopted Halliday's work about modes other than speech and writing (Adami, 2016). It demonstrated an integration of various communicative resources by providing common ground between different modes of communication and interaction within them (Stöckl, 2014). Scholars did not always agree about the relationships between verbal and visual modes within one message. For Barthes (1977), who followed a structuralist approach inspired by Ferdinand de Saussure, the verbal text is predominant, and the visual mode depends upon it. Contemporary scholars, on the contrary, emphasize the primacy and autonomy of the image in multimodal research (T.-K. Lee, 2013).

As semiotics, multimodality research starts from the

“idea that humans make meaning by choosing signs of different types from distinct repertoires, arranging them according to social rules and practices in order to form textual objects or communicative events, which convey more or less determinate messages in situations and contexts shaped by place, time, medium, and culture” (Stöckl, 2014, p. 276).

In English-speaking research on multimodality, Jewitt (2014) systematized three approaches to multimodality: social semiotic multimodal analysis, a systematic functional approach (multimodal discourse analysis), and multimodal interactional analysis. The main difference between these approaches stems “from the historical influences and directions that have shaped them, as well as the degree of emphasis each gives to context, the internal relations within modes or modal systems” (Jewitt, 2014, p. 32).

Derived from Halliday’s (1978) social semiotics theory, multimodality developed from a social-semiotic perspective, where the meaning in all its forms represents a central concept. This meaning appears in social environments and social interactions. The signs in all modes can be combined and made meaningful by the sign maker. Different situations emphasize the potential use of different modes. This approach “is not an analysis of the form of the text, but the analysis of the form of the knowledge that underlines the text” (Machin and Van Leeuwen, 2007: 62). It specifically focuses on a detailed observation of the modes included in the communication, and “the broader discourses, histories, and social factors that shape that” (Jewitt, 2014, p. 33).

A systematic functional approach to multimodality – also called multimodal discourse analysis – was derived from Halliday’s systematic functional grammar approach. It emphasizes understanding of semiotic resources, their systems of meaning, and how people use them in different contexts (Jewitt, 2014). This approach is closely related to what O’Halloran calls multimodal analytics and multimodal digital semiotics. These branches of semiotics study “semantic patterns arising from the integration of language, images and audio resources in multimodal texts” (O’Halloran et al., 2014, p. 386). Although the meaning-making affordances of each of these modes are different, they interact in order to construct a meaning (Unsworth & Cléirigh, 2014).

According to Jewitt (2014), a multimodal interactional analysis aims to describe and comprehend what happens in a given interaction. In this case, not only gaze or gesture are investigated modes, but also postures, movements, spaces, and objects contributing to the

interaction. It is a more moment-focused approach to multimodal communication (Norris, 2014). In this case, it can be closely related to conversation analysis from linguistics.

Visual and textual modes and the media play a significant role in social, political, and economic life which cannot be ignored (Loizos, 2000). As data-driven disciplines, communication and media studies use visuals as prime data. In particular, a large volume of visual data is generated and provided within image-based social media (Pearce et al., 2019). For instance, Flickr, Instagram, Pinterest, Snapchat, TikTok, Tumblr, and YouTube can be considered image-based social media since it is impossible to produce a post within them without opting for a visual mode. Nevertheless, the multimodal nature of such social media platforms cannot be denied. Even though these platforms use visuals, still and moving images, as predominant types of content and are also referred to as visual social media (Leaver et al., 2020), the textual component, i.e., the post's capture or the text within the image, can also influence our relationship with the post. Thus, multimodal approaches remain relevant to a better understanding of communication disseminated via social media (Wessler et al., 2016). More specifically, this approach can be relevant to environmental communication. In the following sections, we will detail the research methods used to investigate multimodal data from social media.

3.2 Research methods for analyzing multimodal data from social media

In this section, we provide an overview of research methods to investigate multimodal data primarily from image-based social media. By multimodal data from social media, we comprehend images, videos, and captions to these media files shared by a particular account on a particular social media platform.

3.2.1 Content analysis

Content analysis is one of the most commonly used research methodologies to research all forms of communication (Berger, 2015, p. 390). Introduced in the early twentieth century, content analysis was initially designed to accurately study human and social phenomena. Later, it was transformed into an advanced form “to provide academics and politicians with the means to police the symbolic arenas of mass culture, and in particular to detect the presence and influence of propaganda” (Deacon et al., 2021, p. 140). Content analysis is employed across various social and human sciences, particularly media, communication, and cultural studies.

According to Wright (1986, p. 125), “content analysis is a research technique for the systematic classification and description of communication content according to certain usually predetermined categories,” it can also “involve quantitative or qualitative analysis, or both.” These predetermined categories are often called coding categories, represented in the form of open or closed questions with proposed answers, depending on the research context. Other scholars prefer the terms “variables” and “values” instead of categories. *Variables* here refer to principal aspects of representation, such as the image’s size, color range, participants, or any other alternative element of representation. *Values* are the parts of variables that possess the same logic attribution or belong to the same class (Bell, 2011).

Content analysis is a preferable research method in communication due to many factors. First, it is unobtrusive. In other words, the researcher does not interfere with what is being studied, as in interviews, for example. Second, content analysis is relatively inexpensive. Third, it can help investigate current events and topics of interest by using materials that are relatively easy to obtain. Finally, the data collected for content analysis can be expressed in numbers, which can provide some critical interpretations for the research. Although content analysis itself can provide us with what is in the materials being studied, it cannot show their effects on people exposed to these materials (Berger, 2015). In addition, the main challenge of content analysis is interpreting quantitative results since their numeral representation “does not translate easily into significance” (Rose, 2016, p. 102).

Rose (2016) defined four steps to content analysis of visual data: finding your images, devising your categories for coding (which should be exhaustive, exclusive, and enlightening), coding the images, and analyzing the results. Additionally, the collected data should be a representative sample, i.e., including the variables related to the proposed hypothesis (Bell, 2011) with determined measurable units of analysis. Moreover, coding the images can have at least two major stages: preliminary data labeling using emergent codes, interpreting the initial coding, and developing more analytical categories for coding, which will constitute the codebook for content analysis (Bazeley, 2013; Saldaña, 2016). Eventually, it is important to obtain reliability in coding by applying intercoder agreement. This will ensure the validity and utility of the findings (Berger, 2015, p. 402).

Various typologies of content analysis can be identified within communication and media studies. They are based on the research design type and the types of analyzed content. Regarding the research designs, there are two approaches to content analysis: quantitative

content analysis and qualitative content analysis, which are an object for debates in social sciences. According to Schreier (2012), qualitative content analysis is a research method that systematically describes the meaning of qualitative material, i.e., newspaper articles, documents, and social media posts. Originating in communication studies (Schreier, 2012), quantitative content analysis was defined as “a research technique for the objective, systematic, and quantitative description of the manifest content of communication” (Berelson, 1952, p. 18). The distinction between qualitative and quantitative content analysis remains subtle or “artificial” and is “a matter of degree” (Schreier, 2012, p. 14). However, a more recent definition of qualitative content analysis by Kuckartz and Rädiker specified that the analysis procedure of qualitative content analysis “is primarily qualitative but can also integrate quantitative-statistical evaluations” (Kuckartz & Rädiker, 2023, p. 21).

According to the types of analyzed data, content analysis can be verbal, visual, or multimodal. The verbal content analysis uses text messages as an object of study. It can be applied to study: transcribed written and oral presentations (Chan & Nyback, 2015); Facebook posts about disinformation (Iosifidis & Nicoli, 2020), articles regarding the refugee crisis from some Spanish newspapers (Ferrández-Ferrer, 2021), articles from newspapers in Brazil and Egypt regarding engaging journalism (Medeiros & Badr, 2022), Twitter content about Jammu and Kashmir regions (Gabel et al., 2022), documents from fair trade organizations in Flanders (Van der Steen & Maesele, 2022).

The corpus for visual content analysis comprises visual data, such as images and videos. This type of analysis was used in the 1990s as an effective way of analyzing manually relatively large numbers of images. Lutz and Collins (1993) suggested that it can include qualitative interpretations and be useful for visual critical methodology. According to Rose (2022), visual content analysis must address all images relevant to the research question. However, in some cases, researchers identify a representative sample to analyze the data. Krippendorff (2013) suggested four sampling strategies: random sampling – using a random number generator; stratified sampling – from subgroups of the dataset; systematic sampling – selecting every tenth image; cluster sampling – choosing a random group from the dataset and selecting images from them only.

One of the most significant studies about climate change visuals implying content analysis was conducted by O’Neill (2020). The researcher examined the denotative content of the visuals based on the coding scheme developed in 2013 (S. J. O’Neill, 2013), which included

the following thematic frames: people, causes, climate impacts, solutions, science & technology, and protest. Each of the thematic frames included sub-themes. For instance, the frame “people” included politicians, scientists, business representatives, and celebrities. Another more recent research on visual content analysis of climate change visual communication on Twitter by León et al. (2022) adapted the coding scheme developed by O’Neill (2017) in combination with the seven principles of effective climate communication developed by the *Climate Visuals* project. These principles included (1) showing “real” people, (2) telling new stories, (3) showing climate causes at scale, (4) visuals with emotionally powerful climate impacts, (5) showing local and serious climate impacts, (6) carefully selecting protesting imagery, (7) understanding the audiences (Corner et al., 2015).

Multimodal content analysis comprises the investigation of multiple modes of a message. In the case of social media, they can be image and capture, video and capture, or image, video, and capture. Multimodal content analysis, according to Serafini and Reid (2019, p. 7), can be referred to as an adaptation of qualitative content analysis and requires “complex relationship among modes present in analog and digital multimodal ensembles, in addition to the affordances and limitations of individual modes.”

Multimodal content analysis is comprised of 11 steps: (1) identifying an area of interest, (2) formulating initial research questions, (3) building the data corpus, (4) determining the object of study, (5) establishing initial categories, (6) creating an analytical template, (7) validating the analytical template, (8) implementing the analytical template on the data, (9) developing potential themes, (10) drawing out implications from the analysis, (11) disseminating findings (Serafini & Reid, 2019). The researchers also proposed a template with analytical categories and features to analyze (Figure 5), which can be compared to the categories for multimodal discourse analysis of advertisements in the magazines proposed by Joly and Martin (2021) and presented in detail in the next part. The common parts of these analysis grids include different elements of visual and verbal modes, such as color palettes, fonts, positions, salience, settings, and the interactions between them. A work by Bouko et al. (2021) represents an exemplary study of multimodal content analysis: the authors quantified ideational and interpersonal functions from a systematic functional approach developed by Halliday (cf. Section 3.1). They adapted them to the coding categories within multimodal content analysis.

Analytical category	Features	Analytical notes
Textual elements: Content	Wine name Winery Location/AVA (American Viticultural Area) Varietal/blend Miscellaneous	
Textual elements: Expression	Font Palette Position/size Salience Style – era Miscellaneous	
Visual images: Narrative	Setting Actors Actions – poses Vectors Theme Miscellaneous	
Visual images: Classificatory	Logo–seal Classification scheme Information provided Hierarchy Miscellaneous	
Design elements	Compositional elements Position/size Materiality Palette Salience Miscellaneous	
Intermodal relations	Composition Complementarity Dissonance Framing Genre	

Figure 5 Analytical template for multimodal content analysis to study wine labels as proposed by Serafini and Reid (2019, p. 15)

In environmental communication research, Molder et al. (2021) applied multimodal content analysis to identify thematic and emotional frames represented in the Instagram posts of environmental activist Greta Thunberg. Content analysis of randomly selected images related to CC topics on Twitter conducted by León et al. (2022) provided practical principles that can foster user interaction on this social media. In their recent study, Nieto-Sandoval and Ferré-Pavia (2024) applied an adapted form of multimodal content analysis, which they called the multiple content analysis approach. In this approach, they combined thematic textual analysis, narrative and framing approaches, and complex categorization of other parameters, such as engagement metrics, main actors, and cited sources in the analyzed posts (Nieto-Sandoval & Ferré-Pavia, 2024).

With the development of cross-platform studies in communication, content analysis has been adopted for cross-platform corpus studies. Hase et al. (2022) studied news production by four popular news outlets in Germany (Spiegel, Süddeutsche Zeitung, Tagesschau, ZDF Heute) with regard to the affordances and logic of platforms (Facebook, Instagram, TikTok, Twitter) and the content shared on their websites. The researchers conducted both automated and manual content analyses.

Deacon et al. (2021, p. 141) argued that the application of content analysis in communication sciences is rising due to the opportunities provided by digital technologies for “computer assisted or entirely automated analyses of large volumes of communication content.” This content can be computationally coded with the help of *MaxQDA*, *NVivo* tools, R, Python packages, or AI tools, such as *Google Vision* or *Open AI*. These computational tools provide a space for data coding, which can significantly reduce the time of labeling or classification, statistical analyses, and visualizations of the results. However, many gaps still exist between the theoretical concepts and the outputs of these tools (Peng et al., 2023). It should also be noted that although the automatic coding process may use computer algorithms to make coding decisions, it still relies on manual approaches to some extent (Hase, 2023; Wiedicke, 2023).

The research applying content analysis should be complemented by other research methods or by qualitative interpretation (Lutz & Collins, 1993) in order to extend the findings by a more detailed analysis of some part of the corpora or by analyzing the effects the message produced on the audiences (Bell, 2011). It can include computational content analysis with AI. The study of Li and Xie is a good example of the combination of multimodal content analysis with AI tools. They analyzed Twitter and Instagram visuals by combining *Google Cloud Vision*

API with manual coding. Although this novel approach opens new horizons in communication research, it can be limited by a complicated relationship between image content and engagement, where image content influences users' engagement and the effects of image characteristics on users' engagement are primarily "context dependent" (Y. Li & Xie, 2020, p. 17).

3.2.2 Multimodal discourse analysis

Multimodal discourse analysis (henceforth MDA) is a prominent qualitative approach to visual and verbal data altogether, which was developed from semiology. Semiology addresses the question of how meaning is made within the image and "offers a certain kind of analytical precision" as content analysis does (Rose, 2022). In general, MDA investigates how social interactions and meaning-making practices occur through multiple modes (Geenen et al., 2015). Two major schools employ MDA for communication research: the French school of post-structuralist semiotics and social semiotics.

Inspired predominantly by Barthes' works on different types of images, Joly and Martin (2015, 2021) suggest three levels for MDA. They include the analysis of the iconic, plastic, and linguistic signs. We summarized and translated a proposed template for MDA developed by Joly and Martin (2021) and illustrated it in Figure 6.

Iconic signs	List of iconic elements	First-level signification (denotation)	Second-level signification (connotation)
Plastic signs	Plan	Signification	
	Framing		
	Angle		
	Focus		
	Composition		
	Forms		
	Dimensions		
	Colors		
	Light		
	Textures		
Linguistic message	Anchoring and relaying	Signification	
	Stylistic devices		
	Font		
	Style of letters		
	Color of the text		

Figure 6 Template for multimodal discourse analysis of a magazine advertisement, translated from Joly and Martin (2021)

The *iconic* or figurative message from Figure 6 is related to the detailed description of elements represented in the image and their denotation and connotations. Denotation is first-level signified or signification, i.e., the first or literary meaning of the element. Connotation is a symbolic message with a high-level second meaning connected to the cultural knowledge shared by enunciators and their audiences (Joly & Martin, 2021).

The *plastic* message analysis includes the identification of the signification or meaning of different elements of the multimodal document: plan, framing, angle, choice of the lens or focus, composition, forms, dimensions, colors, lights, and textures. The plan or the frame, “*cadre*” in French, is the boundary of visual representation. Framing refers to the image size presumably resulting from the distance between the subject photographed and the lens. Angles represent the perspective from which the visual elements are viewed or captured, e.g., eye level, high angle, low angle, bird’s eye view. Focus is a representation of the space and perspective within the analyzed visual. The composition or internal geography of the visual message plays an essential role in the hierarchy of vision and guiding the way the image is read. Forms are shapes or specific ways of representations within a composition. Dimensions are the sizes of different elements within the visual. Analyzing colors may include the study of color contrasts or saturation, e.g., visuals with full bright colors or black-white may have different effects on the viewer in different contexts. In addition, the symbolism behind the use of color is a significant element in MDA. Light refers to the identification of illuminated or darkened objects and their connotations. In two-dimensional images, textures are related to the direct or indirect representation of the third dimension, giving different effects on the visual (Joly & Martin, 2021).

The *linguistic* message relates to the text-image relationships within a multimodal document. It can also be observed from the perspective of plastic messages: the use of font and its forms, style of letters (bold or italic), and text colors. However, the linguistic analysis of a textual component can also occur here to observe the use of different stylistic devices, such as metaphors, oxymorons, word plays, irony, or sarcasm.

Communication studies have integrated a post-structuralist semiotic approach, incorporating variations of different semiotic theories, with each approach offering a unique perspective or adaptation of the broader semiotic heritage. The example works of applying MDA include the analyses of fashion brands (Mazzalovo, 2007), brand images (Rossolatos, 2012), brand logos (Kucuk, 2015), and environmental communication by NGOs (Catellani,

2018, 2022). Another specific example is proposed by Benjaminsen (2021), who suggested three case studies on environmental discourse analysis of images related to landscape degradation by drawing on denotation, connotation, and myth notions developed by Barthes.

From a social semiotics perspective, MDA comprises three levels of analysis: representational meaning, interactive meaning, and compositional meaning (Harrison, 2003; Kress, 2010, 2012; Kress & Leeuwen, 2001). Decoding *representational* meaning means analyzing what the modes are about. It can include the identification of narrative and conceptual structures. Narrative visuals enable viewers to create a story and can include motion. The conceptual structure of representational meaning represents “concepts” of **what** the image represents: group representation, part-whole structure, and symbolic structure (Harrison, 2003). The *interactive* meaning is responsible for the **relationships** between the modes. The eyeline of the represented elements and the viewer, social distance and intimacy, horizontal angle (angle of involvement), and vertical angle (angle of power) are the elements of the analysis on this level. The *compositional* meaning of a multimodal document enables one to investigate the **organization** or **structure** of the message. It incorporates the analysis of positions (left/right, top/bottom, central/margin), the represented elements, the elements’ sizes, the focus’s sharpness, tonal contrast, frame lines, pictorial framing devices, and the modality. By analyzing modality, we investigate how we feel about the multimodal message. Color saturation, contextualization, presence or absence of perspective, and lights can be helpful for this level of MDA (Harrison, 2003, p. 58).

Many studies in environmental communication applied the social semiotic approach MDA to analyze social media data. Maier (2011) studied how knowledge was communicated by a CNN Greenwashing video posted on YouTube. The researcher inspected image attributes, voice, captions, and knowledge about social actors. Hautea et al. (2021) collected 6560 videos related to the #climatechange hashtag, 57 of which were carefully selected for a qualitative MDA to identify the key themes of the videos.

Some scholars combined MDA with other theories and methods. Nurfaizah and Harti (2022) combined Kress’ and van Leeuwen’s (2020) theory of multimodality and the intersemiotic complementarity of Royce (2013) to understand which multimodal elements are used to create the meaning and how visual and linguistic elements are interplayed in representing protest on CC mitigation. Their combined approach included the analysis of visual meaning (top-right, bottom-right, center positions, use of colors), linguistic meaning (CC-

related lexicon), and intersemiotic complementarity (intersemiotic repetition and intersemiotic synonym). In their recent study, Fine and Love-Nichols (2023) combined multimodal close discourse analysis, which is similar to the social semiotic approach, rhetoric analysis, and different quantitative methods to examine different elements of Twitter and Instagram, such as visuals, textual content, hashtags, embedded messages, and comments.

To recapitulate, different versions of MDA appeared in different schools of semiotics, linguistics, and communication. They all have a similar idea of studying multimodal messages by analyzing a combination of different elements and their significations. They differ in their approaches to the analysis procedure. As a qualitative approach, MDA cannot be applied to a large number of media data. However, it can be used in combination with other methods. To select multimodal messages for qualitative analysis, one may use content analysis to pre-select particular data regarding the research question. Not much research exists on combining different qualitative and quantitative approaches to social media data. Fewer studies attempted to conduct a cross-platform MDA, including multimodal data from multiple platforms.

In this work, we adopt an analysis grid developed by Joly and Martin (2021) to structuralize the meanings of Instagram posts. We present the detailed analysis procedure in Section 3.2.2 *Multimodal discourse analysis*. For MDA, we select specific Instagram posts based on the results of the multimodal content analysis. The selection criteria and the analysis results are discussed in Chapter 7 *Mixed-method case studies*. Therefore, this research significantly contributes to the methodological development of combined quantitative and qualitative research methods in environmental communication.

3.2.3 Computer-assisted linguistic analysis

A corpus of social media data can include visual and verbal elements, which are “notorious for their use of non-conventional and innovative word forms” (Sardinha et al., 2022, p. 658). These verbal messages can be studied by employing linguistic analysis. Derived from corpus linguistics, which is sometimes called statistical linguistics, linguistic analysis observes verbal data from different perspectives. More precisely, it allows the investigation of various aspects of the different levels of the language, from the macro-level of genre and text analysis to the micro-level of sentences and words (Fløttum, 2010). This analysis can be multi-dimensional and include the following steps: corpus design and compilation, selection of linguistic features, tagging, frequency counts, factor analysis, scoring, and interpretation of the factors (Sardinha

et al., 2022). The most frequently used tools for linguistic analysis are *Wordsmith* and *Sketch Engine*.

A body of research exists on linguistic analysis regarding CC and sustainability topics from official documents, traditional and online media, and social media. Koteyko et al. (2013) examined word frequencies from the user comments on the online forums of the UK tabloid. Barkemeyer et al. (2016) carried out a linguistic analysis of the IPCC summaries based on word frequency. With the help of computational tools, the researchers identified the most popular terms, underlining their positive and negative meanings, which were further used to understand the readability of the IPCC reports. A comparative study of the IPCC summaries was proposed by Fløttum and Dahl (2017), whose research was focused on the levels of uncertainty in the IPCC reports. They analyzed the uncertainty levels from the language's micro-level and a global text analysis.

Many single-platform studies applied various types of linguistic analysis to social media posts about CC-related topics. They were focused on the investigation of word frequencies from Twitter messages (Cody et al., 2015; Jacques & Knox, 2016), frequency, distribution, and keyness of hashtags from Twitter (Bednarek et al., 2022; Pizarro Pedraza et al., 2022), keyness and intertextuality of news articles and Twitter hashtags word frequencies from Instagram posts about #sustainabletourism (Palazzo et al., 2021).

In this study, we adopt computer-assisted linguistic analysis to observe the use in the context of specific words and phrases in verbal data and to identify the markers of obstacle discourse. We detail the procedure in Section 4.3.3.4 *Computer-assisted analysis of the comments*.

3.2.4 Sentiment analysis

Sentiment analysis, also referred to as opinion mining, is an element of natural language processing (NLP) responsible for extracting subjective information, attitudes, opinions, and emotions from textual or visual data. It is more frequently used to classify the elements within these texts as “positive,” “negative,” or “neutral” according to the conveyed opinions. The positive sentiment reflects a positive or optimistic stance. Negative sentiment indicates a negative or pessimistic tone. Neutral sentiment characterizes text with a limited emotional tone (Lheureux, 2023).

Several NLP or ML models that can perform sentiment analysis are available for researchers, such as *TextBlob*, *BERT*, *EmoLex*, *VADER*, *Text2emotion*, and others. Depending on the research aims, these models can be monolingual or multilingual. Sometimes, sentiment analysis is combined with other NLP methods, such as topic modeling, as in the study by Lin and He (2009) on the movie review dataset or in the work by Dahal et al. (2019) on climate-related tweets. In the following paragraphs, we describe each model by providing exemplary studies.

The *EmoLex* model was developed by the National Research Center Canada in 2011. This model represents a list of English words in relation to their associations with eight emotions – anger, anticipation, disgust, fear, joy, sadness, surprise, trust – and two sentiments, i.e., positive and negative. In 2022, over 100 languages were added to the model by an integrated Google Translate (National Research Council Canada, 2022). Loureiro and Alló (2020) used this model to study energy communication on Twitter in Spain and the UK. The researchers combined word clouds and word frequency analyses with sentiment analysis of the tweets. Their results demonstrated that energy themes were more frequently related to reducing emissions, providing cleaner energy, and renewable energy support. In both countries, the sentiment analysis of the tweets showed a somewhat positive perception of renewable energies (Loureiro & Alló, 2020).

VADER, from Valence Aware Dictionary and sEntiment Reasoner, is a sentiment analysis model pre-trained on microblog posts (Hutto & Gilbert, 2014). The *VADER* model looks into the document's words and suggests a preliminary sentiment score, which is further processed according to “five different rules based on general syntactic and grammatical conventions to modify that score.” The resulting score is “between –1 (strongly negative) and +1 (strongly positive)” (Dahal et al., 2019, p. 6). This model was efficiently used to investigate the public's feelings towards CC-related topics by Dahal et al. (2019), whose results show particularly negative messages on Twitter in reaction to particular climate-related events. In this study, authors emphasized the importance of mentions and hashtags within certain tweets since they contain the context of the message and, therefore, should be considered for further research.

Text2emotion is a Python package that can detect five basic emotions, such as anger, happiness, surprise, fear, and sadness, in short messages. This method was applied by Shamoi et al. (2022) to investigate English tweets related to vegan lifestyles from 2010 to 2022. The

authors combined a machine learning approach based on mutual information, which is used to identify “the strength of a semantic association between two words,” with emotion identification from Text2emotion python package. This method showed a relatively good result (0.77) compared to other methods, such as VADER (0.69).

BERT is a machine learning technique for sentiment analysis developed by Google. This model was “trained on a large volume of text, including 800 million words from BooksCorpus and 2,500 million words from English Wikipedia”. Its architecture allows the model to comprehend word context by considering preceding and subsequent words in a sentence (Lheureux, 2023).

A recent study by Lheureux (2023) highlighted the significance of social media analytics and machine learning models by investigating Twitter data to assess public sentiment for predicting environmental, social, and governance controversies. By giving precedence to communicating with stakeholders on social media platforms, companies can develop a more profound comprehension of societal expectations. In particular, the author suggested that companies can utilize positive and negative sentiments on social media as indicators for informed decision-making, operational enhancement, and reputation building. Finally, the author outlined the necessity of investigating the data beyond Twitter to provide new perspectives to the understanding of the environmental, social, and governance controversies.

To summarize, sentiment analysis remains a frequent methodology to analyze data from social media, including messages about climate change and sustainability transition, for example, to identify audiences’ perceptions of differently framed social media posts (Müller-Hansen et al., 2023) or to identify climate skeptical messages (Hodson et al., 2018). Most sentiment analysis models are adapted to the analysis of short messages and, therefore, are more frequently used for Twitter data. In this thesis, we adapt this method to analyze the comments on Instagram posts, extending the method beyond previous Twitter studies. We present a detailed analysis procedure in Section 4.3.3.2 *Sentiment analysis of the comments*.

Although Instagram comments are limited to 2200 characters, users prefer to post short comments (Manikonda et al., 2014), particularly when they express politeness and compliments (Indah & Rifana, 2017). Sentiment analysis is a constantly developing approach. Today, we can benefit from multilingual open-source libraries adapted to researchers with different programming skills. However, in some cases, this method should be complemented by different qualitative approaches since it neither considers the message’s specific context nor detects

stylistic figures, such as irony or sarcasm (Dahal et al., 2019; Loureiro & Alló, 2020). In this thesis, we combine the results from sentiment analysis with content analysis and computer-assisted linguistic observations to provide robust results.

3.3 Mixed methodologies for analyzing climate change communication

Conducting environmental communication research with online data can be achieved by combining multiple methods (O'Neill & Smith, 2014) from different disciplines. As Gerbner (1958, p. 107) mentioned, the challenge of communication research is “to combine the empirical methods with the critical aims of social science, to join rigorous practice with value-conscious theory.” Some scholars attempted to combine various methods for communication research. Combining an online survey with the analysis of study group discussions about CC images in three countries (Germany, the UK, and the USA) was suggested by Chapman et al. (2016). A more recent study on the emotional characteristics of images about CC-related topics combined a panel survey with the evaluation of CC images selected from Google search (Lehman et al., 2019).

Analyzing social media data using digital methods can supplement traditional approaches, offering enhanced insights into the organization and functioning of these platforms. Additionally, it can “perform a cultural and societal diagnostics” (R. Rogers, 2013, p. 3). Digital methods for analyzing social media can be applied within different stages of research: data collection, data sorting or filtering (keywords), and data analysis that uses software tools for qualitative or quantitative interpretation (Rose, 2022). These tools can also be visualization tools such as *ImageSorter* or *Image Plot* – as from the studies of Pearce et al. (2019) and Tifentale and Manovich (2015) – and can help visualize the data according to its similarity metrics, such as colors, shapes, date and time. Rogers calls this type of visualization a metapicture (2021), which entails interpretive decisions and computer skills. Metapictures, as the representations of research results, connect qualitative and quantitative analyses of visual data and are referred to as an analytical reading of groups of images. Serving as “the prompt for interpretation,” metapictures can reflect image trends, engagement, and circulation between the platforms (R. Rogers, 2021). In addition, many authors suggest hybrid approaches to climate change communication, where digital methods can benefit from more profound interpretative work involving qualitative engagement (Mooseder et al., 2023; Rose, 2022).

To conclude, merging various methods to analyze social media data is a novel approach to communication research. Many scholars see high potential in integrating various research methods and theoretical concepts from different disciplines, which contributes to reducing the gaps between the disciplines. However, particular attention should be paid to the systematization of such research (Canon et al., 2022).

In line with previous studies, **this thesis aims to systematize different research methods to study multimodal communication about CC mitigation on Instagram.** Specifically, we apply an automated content analysis to select a corpus of Instagram posts concerning the food, energy, and transport sectors. The selected posts are further analyzed with the help of multimodal content analysis to map the environmental discourses. Then, four subcorpora are selected for mixed-method case studies to investigate how the obstacles to pro-environmental action and environmental values are represented in the posts and the comments to them. The detailed procedure for each type of analysis is provided in Chapter 4 *Research aims, data, and research design*.

Chapter 3: Key elements

- **Multimodality** is “representations in many modes” (Kress, 2010, p. 22), such as visual, verbal, or audio.
- **The French school of semiotics** adopted a rather structuralist approach to multimodality developed by Barthes (1967), which addresses multimodal signs within cultural and social contexts by considering their denotation and connotation.
- **In Anglo-Saxon social semiotics**, multimodality demonstrated an integration of various communicative resources by providing common ground between different modes of communication and interaction within them (Stöckl, 2014).
- **Content analysis** is “a research technique for the systematic classification and description of communication content according to certain usually predetermined categories”(Wright, 1986, p. 125). Regarding the research designs, there are two approaches to content analysis: quantitative content analysis and qualitative content analysis. Regarding the type of content, content analysis can be verbal, visual, and multimodal.
- **MDA** investigates how social interactions and meaning-making practices occur through multiple modes (Geenen et al., 2015). In this study, we adopt a multimodal discourse analysis based on the works of Joly and Martin (2015, 2021).
- **Computer-assisted linguistic analysis** observes verbal data from different perspectives by using computational tools. More precisely, it allows the investigation of various aspects of the different levels of the language, from the macro-level of genre and text analysis to the micro-level of sentences and words (Fløttum, 2010). This analysis can be multi-dimensional and include the following steps: corpus design and compilation,

selection of linguistic features, tagging, frequency counts, factor analysis, scoring, and interpretation of the factors (Sardinha et al., 2022).

- **Sentiment analysis** is an element of NLP responsible for extracting subjective information, attitudes, opinions, and emotions from textual or visual data.

Part 2 Methodology and data

Chapter 4 Research aims, data, and research design

The present Chapter links the literature review with our research project. Specifically, Section 4.1 introduces the research aims and objectives, which align with previous studies. Section 4.2 *Corpus selection, data collection, and data adaptation* presents the selected corpus of Instagram posts by French, Belgian, and Norwegian environmental OLs and OLOs. In addition, it discusses the methods used to collect the data and to adapt it to our research needs. Finally, Section 4.3 *Research methodology* demonstrates the analysis procedures: automated content analysis, multimodal content analysis, multimodal discourse analysis, content analysis, sentiment analysis, and computer-assisted linguistic analysis.

4.1 Beyond the state of the art: Research aims and objectives

The state of the art has revealed a fundamental problem in visual analyses of CC communication on social media. Most studies have focused on Twitter/X data, which remains predominantly verbal (Vaughan & Johns, 2021). The research on CC visual communication has mainly focused on analyzing the communication of environmental NGOs, media channels, and climate activism, predominantly on Twitter. Moreover, previous research has either paid little attention to the geography of usage by studying hashtag-based data or focused primarily on North American and English-speaking countries. While single-platform studies remain an established norm for social media analysis (R. Rogers, 2017), more research is still needed in the field of CC communication by combining and comparing the data from different “novel social media platforms” (M. S. Schäfer, 2020, p. 129), in particular through multimodal analysis. Thus, we propose to address these gaps in this work. Specifically, the present research provides a geographical focus that has not been applied in previous studies. In line with the 2O2CM Project, we propose an exploratory study of three European countries – Belgium, France, and Norway. In addition, we combine different research methods to investigate the obstacles to CC mitigation in Instagram posts by environmental OLs and OLOs and in the comments to them.

Nowadays, CC communication has taken a systematic direction, integrating many different disciplines, approaches, and topics within the problem. However, “there is more work to be done to systematize climate change communication” and to build bridges between the disciplines, which is a complex and complicated process (Canon et al., 2022, p. 14). Given that

novel approaches to climate change communication on social media, such as the value-based approach, remain widely understudied (Fage-Butler, 2022), **we propose to link the advances of environmental psychology to communication research**. More precisely, we suggest identifying the value clusters and their relations to the obstacles and barriers mentioned in the posts of environmental OLs and OLOs in the food, energy, and transport sectors. Previous research in environmental psychology from survey data argued that “widespread climate action seems more likely when biospheric values are endorsed strongly throughout society” (Bouman, Van der Werff, et al., 2021, p. 103). Furthermore, stronger endorsement of egoistic and hedonic values can discourage climate action (Bouman, Steg, et al., 2021, 2021). In this work, we test this hypothesis on social media data and suggest that analyzing the relationships between actions, actors, and values will provide a deeper understanding of barriers to climate action presented in social media posts. As a result, this study will complement the research on obstacles and barriers to pro-environmental action, which is generally based on survey data.

The choice of the energy, food, and transport sectors stems from the *Special Eurobarometer 513 report* (2021), which outlined that there have been decreases in adapting individual actions to help tackle climate change in these sectors. Notably, compared to reducing waste – which is done by 75% of Europeans – only 42% of European citizens try to lower energy consumption, and even fewer Europeans prioritize organic alimentation (32%) and environmentally-friendly alternatives to private cars (30%). Thus, communication on CC mitigation actions in these sectors demands particular attention.

The present research project points out the problems of multimodal CC communication via one of the most popular visual social media in the EU, Instagram, since it can be used as an effective tool for sharing knowledge on CC mitigation with a broad spectrum of audiences. Based on the previous elements, our **main research questions** are

1. What are the semiotic forms of individual and organizational discourses on climate change efforts in food, transport, and energy sectors communicated in the posts of Belgian, French, and Norwegian opinion leaders on Instagram between 2021–2022?
2. How are these messages perceived by the audiences in terms of obstacles to pro-environmental action and environmental values?

To contextualize these questions, we suggest a set of **contributory research questions**:

- 1) What are the tendencies in Instagram posts by environmental OLs and OLOs concerning climate actions in the three sectors?

- 1.1) Which climate actions related to solutions to CC mitigation are represented in the posts?
- 1.2) Which actors are represented as responsible for CC mitigation?
- 1.3) Which obstacles to pro-environmental action are represented in the posts?
- 1.4) Which environmental values are represented in the posts?
- 1.5) Which values appear in relation to the identified obstacles to pro-environmental behavior?
- 2) How are these multimodal posts interpreted by the audiences expressing their opinions in the comments to these posts in terms of responsibilities, obstacles, and values?
- 2.1) Who is mentioned as responsible for acting for CC mitigation in the comments?
- 2.2) Who is criticized for their irresponsible behavior towards CC mitigation in the comments?
- 2.3) Which obstacles to pro-environmental behavior are mentioned in the comments, and how?
- 2.4) Which environmental values are related to the identified obstacles in the comments, and how?

To address our research questions, we “go beyond a qualitative approach,” as Fage-Butler suggests (2022, p. 5), to a value-based study in environmental communication and employ a mixed-method research design. First, environmental OLs and OLOs are carefully chosen on Instagram according to particular criteria. This procedure is described in detail in Section 4.2.1 *Selecting accounts of climate change opinion leaders and opinion-leading organizations*. Second, multimodal data from selected accounts was collected with the help of computational tools and is presented in Section 4.2.2. Third, the collected data is further filtered according to the date (January 2021–March 2022) to achieve homogeneity and representativity of the corpora. The next step of the research comprised automated content analysis, which allowed the identification of the posts within three thematical categories regarding CC mitigation: food, energy, and transport sectors. The posts related to these three topics are analyzed using multimodal content analysis, illustrated in Section 4.3.2 *Multimodal content analysis: codebook and procedure*.

The multimodal content analysis results allowed us to select four subcorpora, including Instagram posts containing the highest number of obstacles. Each subcorpus represents a mixed-method case study. First, each case study combined MDA and corpus-assisted linguistic analysis of the posts. The objective of qualitative multimodal analysis in our research was to observe in detail the interaction of images, texts, music, sounds, and cultural context, taking into account the affordances of Instagram. As in the research by Hautea et al. (2021), intertextual references, such as hashtags or mentions of influential accounts, were also taken

into consideration. Second, the comments to the posts were analyzed with the help of content analysis, sentiment analysis, and computer-assisted linguistic analysis. This complex procedure allowed us to identify the topics representing public opinion regarding environmental values, obstacles to pro-environmental behavior, and the actors behind the action and inaction. Section 4.3.3 *Case studies' analyses: a mixed-method* approach details the mixed-method research design applied to the case studies.

To validate the proposed multimodal content analysis method, we effectuated a preliminary case study based on the Instagram data by the French and Belgian groups of the *Youth for Climate* movement on Instagram. During this preliminary investigation, we adapted our codebook questions and categories. In addition to this, several hypotheses have emerged during this preliminary case study of youth climate movements. We address these hypotheses in our main study. Hypothesis 1 is linked to the previous research by Bouman et al. (2021).

Hypothesis 1:

The obstacles to pro-environmental behavior in both posts and comments to them will be predominantly referred to the egoistic or hedonic values.

Hypothesis 2 reflects our observations of multimodal data during the preliminary case study.

Hypothesis 2:

The obstacles will be more clearly stated in the verbal mode of the posts, i.e., captions or text-on-image elements, on Instagram.

Hypothesis 3 emerged during the literature review and is linked to environmental communication studies on skeptical data on Instagram, which were detected with the help of sentiment analysis (Hodson et al., 2018).

Hypothesis 3:

The sentiment analysis of the comments will reveal messages, including obstacles to pro-environmental behavior or skeptical comments, which will be labeled as “negative” or “mostly negative.”

These hypotheses were further verified during the data analyses. The data analyses are presented in Chapters 5–7. We start with a general examination of the corpus data and the statistical analysis of the metadata obtained for the posts (Chapter 5 *General examination of the corpus data*). Then, we discuss the results from the multimodal content analysis of the posts considering the sustainability transition in the food, energy, and transport sectors in the three

countries (Chapter 6 *Multimodal content analysis of Instagram posts: Corpus21-22_FET*). Finally, we present four case studies (Chapter 7 *Mixed-method case studies*). Each chapter concludes with a synthesis, discussion, and reflections on the data analysis. Chapter 8 *Conclusion* is dedicated to the general conclusions, limitations, and future perspectives of the present work.

4.2 Corpus selection, data collection, and data adaptation

To address our research questions, we built a single-platform corpus of multimodal posts by environmental OLs and OLOs from Instagram. In the following sections, we delineate the process of selection of the accounts of environmental OLs and OLOs from Instagram (Section 4.2.1), the methods used to collect the corpus data (Section 4.2.2), and the ethical requirements (Section 4.2.3).

4.2.1 Selecting accounts of climate change opinion leaders and opinion-leading organizations

4.2.1.1 Criteria of opinion leadership on social media

As discussed in Section 1.2.2, we define environmental OLs as engaged and competent individuals, i.e., they have a certain level of expertise in sustainability, who address the issues related to climate change problems and signal how others should respond or behave to reduce high consumption lifestyles. They can be politicians, activists, greenfluencers, or experts in other fields related to CC and sustainability. Environmental OLOs are organizations involved in the dissemination of environmental and climate change-related information, drawing particular attention to proposing solutions for how others should react to contribute to climate change mitigation strategies. These organizations can be represented by environmental NGOs, social movements, political parties, or media sources focusing explicitly on CC and sustainability.

To validate social media accounts of environmental OLs and OLOs in Belgium, France, and Norway, we propose the following criteria: (1) enduring involvement and information sharing, (2) interpersonal influence, (3) expertise, (4) intermediality, and (5) interconnectedness (Corey, 1971; Flynn et al., 1996; Nisbet & Kotcher, 2009; Turcotte et al., 2015; Venkatraman, 1989). The opinion-leading accounts were evaluated by applying closed questions-criteria to confirm the opinion leadership of the selected accounts.

(1) To guarantee enduring involvement and information sharing, climate change OLs and OLOs should write about CC- and environment-related topics from January 2021 and earlier. Users' identification of themselves as involved actors can also play an important role in identifying opinion leadership. To evaluate this criterion, we suggest that these accounts should mention climate-, environment-, and ecology-related words and emojis in their Bio. These accounts can be monomorphic or polymorphic. Specifically, *monomorphic* accounts are focused on communicating about issues related to climate change only. *Polymorphic* accounts present climate change themes as one of their key subjects; however, other social issues can also be covered by the account's user.

(2) The interpersonal influence of online OLs and OLOs was measured by the number of accounts' followers, which had to be more than one thousand. This number results from a developing notion of micro-influencing accounts in marketing (Rios de Castro Marques et al., 2020). According to the research work of De Vries (2019), the number of followers can be effective in identifying an account's credibility only concerning the number of likes and comments on the posts, not just the number of followers themselves. Following this idea, we argue that a large number of followers cannot always provide a high engagement rate. This can be further verified while analyzing the collected data for the present research.

(3) To evaluate the user's level of expertise in climate change and environmental issues, we suggest verifying if the user adds references to their information sources. These references can be introduced in visual or verbal modes. Regarding the visual mode, screenshots of journals, newspapers, or experts' pages can be comprehended as references to the source of information posted by the account. Referencing in verbal modes can include phrases like "source of information" or "according to."

(4) To measure users' intermediality, we suggest confirming if the account appears on other platforms and websites. In other words, the name or the username of the individual or organization should appear at least three times in other internet articles and social media platforms, howbeit this should not include their personal profiles on other social media. In our case, this verification was done by using Google Search.

(5) To verify the account's interconnectedness, we considered the user mentioning at least three other accounts related to climate change or environmental topics. We also verified whether the selected account follows other climate change-related accounts or individuals and/or organizations. In case an account has more than 1000 followers, only 500 were used to

verify this parameter since the following list on Instagram is ordered by who one follows and who they have more mutual followers with (D. Johnson, 2023).

To recapitulate, our criteria for selecting environmental OLs and OLOs can be compared to a two-step filtering of accounts of sustainability influencers proposed by Chwialkowska (2019) and discussed in Section 2.3 *Opinion leaders and organizations: how to identify*. We believe that this complex and rather qualitative approach can efficiently identify the accounts of environmental OLs and OLOs. However, some limitations should be considered during the selection stage and the interpretation of the analysis results:

- Some accounts may disappear over time;
- The followers can be synthetically gained, e.g., by purchasing subscriptions to bot accounts;
- Not every account puts a @ mention sign while mentioning other accounts, which complicates the verification of the number of mentions of a particular account.

4.2.1.2 Selecting the opinion-leading accounts from Instagram

To analyze visuals and texts published by environmental OLs and OLOs, we obtained this data from Instagram by applying a mixed approach to data collection. First, the corpus of climate change-related hashtags was collected with the help of computational tools. These data were further used to identify the most influential Instagram accounts posting about climate change issues. Second, the accounts of OLs and OLOs were manually selected on Instagram according to the criteria described in the previous section. Finally, the data obtained from accounts were filtered according to metadata, i.e., according to date, to select a more contextualized and homogenous corpus for the research.

As the data collected from hashtags can be used to determine influential accounts (Aleahmad et al., 2016), we collected a thematic corpus of posts that included CC-related hashtags within the countries of the Project. Since it is impossible to collect Instagram posts based on their geographical position only, we manually selected 39 thematic hashtags related to climate change subjects in Dutch, English, French, and Norwegian. They included #climatechange, #climateaction, #ecologie, #ecoresponsable, #durable, #environnement, #climatemergency, #climat, #developpementdurable, #transitionecologique, #changementclimatique, #écoresponsable, #sauverlaplanete, #durabilité, #ecogeste, #energiesrenouvelables, #réchauffermentclimatique, #ecogectes, #loiclimat, #criseclimatique,

#ecologiste, #giec, #ipcc, #agirpourleclimat, #klimaatverandering, #klimaat, #klimaatmars, #klimaatactie, #klimaatcrisis, #klimaatpositief, #klimaforandringer, # bærekraftigutvikling, #ecofatigue, #globaloppvarming, #klimaattop, #klimaattrapport, #backtotheclimate, #klimaatopwarming. The hashtags played the role of an entrance point to the data within the geographical area of the research. The data collected from hashtags included 7907 posts with 15622 images and 798 videos.

The collected data helped us detect some accounts that largely contribute to the dissemination of information regarding CC. The users posting more frequently with the obtained hashtag-based data were added to the preliminary list of the accounts of environmental OLs and OLOs for further manual validation.

Based on the five criteria of opinion leadership presented in the previous section⁸, the selected accounts from the hashtag-based corpus were further categorized as environmental OLs or environmental OLOs. As a result, the accounts of non-governmental organizations constituted the corpora of environmental OLOs in the target countries, such as Fridays for Future, Friends of the Earth, Greenpeace, WWF, and Youth for Climate.

Further manual selection of the accounts was applied to broaden the corpora by including the accounts of individuals and smaller organizations. A new account on Instagram was created to minimize the influence of the platform's algorithms on previous private accounts. We then followed the selected environmental organizations from the first step of data collection. Then, we looked at the first 500 accounts of followers of environmental organizations, which were determined as influential accounts from the collected hashtag-based data. During this observation, we made a list of accounts that post about climate change-related topics. These accounts were accounts of both individuals and organizations and had to be open and public. The selected accounts were further evaluated according to the same five criteria of opinion leadership, see Figure 7.

⁸ enduring involvement and information sharing, interpersonal influence, expertise, intermediality, and interconnectedness

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	username	Type of the ac	since 202	M or P	Followers	Follow other	Mention oth	In other t	Use referenc	Climate in BK	OL	OLO	country
2	adelalidcha	Individual	yes	Monomorphic	yes	yes	yes	yes	yes	yes	yes	no	Belgium
3	affaireclimat	Organisation	yes	Monomorphic	no	yes	no	yes	yes	yes	no	no	Belgium
4	alain_maron	Individual	yes	Polymorphic	yes	yes	yes	yes	yes	yes	yes	no	Belgium
5	anuna_dewever	Individual	yes	Monomorphic	yes	yes	yes	yes	yes	yes	yes	no	Belgium
6	barbara_trachte	Individual	yes	Polymorphic	yes	yes	yes	yes	yes	yes	yes	no	Belgium
7	benoithellings	Individual	yes	Polymorphic	yes	yes	yes	yes	yes	yes	yes	no	Belgium
8	celine_tellier_ministre	Individual	yes	Monomorphic	yes	yes	yes	yes	yes	yes	yes	no	Belgium
9	christosdoulkeridis	Individual	yes	Polymorphic	yes	no	no	no	no	no	no	no	Belgium
10	cleanwalkerbe	Organisation	yes	Monomorphic	yes	yes	yes	yes	yes	yes	no	yes	Belgium
11	clientearth_	Organisation	yes	Monomorphic	yes	yes	yes	yes	yes	yes	no	yes	Belgium
12	cncd_11	Organisation	yes	Monomorphic	yes	yes	yes	yes	yes	yes	no	yes	Belgium
13	davidclarinval	Individual	yes	Polymorphic	yes	no	no	yes	yes	no	no	no	Belgium
14	eatslocal.be	Organisation	no	Monomorphic	yes	no	no	yes	no	no	no	no	Belgium
15	econocho	Organisation	yes	Monomorphic	yes	yes	yes	yes	yes	yes	no	yes	Belgium
16	ecolobe	Organisation	yes	Monomorphic	yes	yes	yes	yes	yes	yes	no	yes	Belgium
17	ecoloj	Organisation	yes	Monomorphic	yes	yes	yes	yes	yes	yes	no	yes	Belgium
18	elkevandenbrandt	Individual	yes	Polymorphic	yes	yes	no	yes	no	no	no	no	Belgium
19	genotzoe	Individual	yes	Polymorphic	yes	yes	yes	yes	yes	yes	yes	no	Belgium
20	goodmorninglau	Individual	yes	Monomorphic	yes	yes	yes	yes	yes	yes	yes	no	Belgium

Figure 7 Validation of OLs and OLOs

Overall, 175 accounts were added to the list for further observation and confirmation of their opinion leadership. The OLs and OLOs were selected from June 2021 to October 2021. The selected accounts were evaluated in January 2022 according to the developed criteria for measuring opinion leadership. 120 accounts were confirmed to be either the account of environmental OL or OLO. Among them, 73 accounts represent OLs, and 47 accounts represent OLOs. The detailed numbers of selected accounts by country are illustrated in Figure 8.

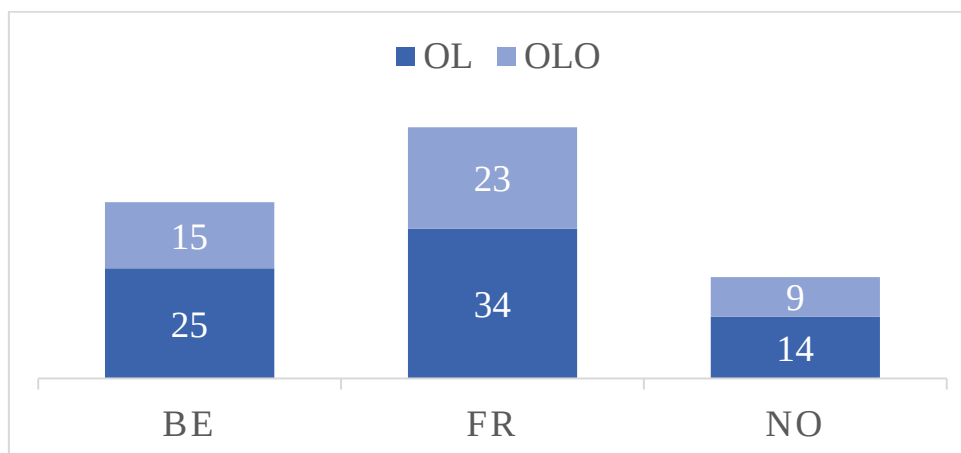


Figure 8 Numbers of selected accounts of environmental OLs and OLOs

As shown in Figure 8, the French data represents the highest number of accounts. This can be explained by the higher number of followers of French organizations observed on Instagram, which was used to select environmental OLs and OLOs. For instance, the Instagram accounts of Greenpeace count 328k followers in France, 32,3k in Belgium, and 18,1k in Norway (Data accessed 27.11.2023). These statistics and the numbers of followers of the two other accounts

of major organizations used in the selection of environmental OLs and OLOs are demonstrated in Table 3.

Table 3 Numbers of followers for the accounts used for the selection of OLs and OLOs

Account on Instagram	Number of followers in Belgium	Number of followers in France	Number of followers in Norway
Greenpeace	32,3k	328k	18,1k
WWF	14,7k	263k	40,5k
Youth movements' accounts	15,5k for @youth.for.climate	29k for @youthforclimatefr	2854 for @skolestreik_norge

In addition to the fact that the Norwegian accounts used for selecting the OLs and OLOs have a smaller number of followers, another factor can be related to the bias of account selection. This factor relates to the researcher's personal experience and professional background, who has lived in France and Belgium for the last six years.

To summarize, the selection of accounts of environmental OLs and OLOs comprised several steps: preliminary observation of hashtag-based data, observation of followers of large environmental NGOs and social movements to shortlist potential accounts of environmental OLs and OLOs, and manual selection of accounts according to five criteria. Although this process was time-consuming, it allowed us to list the accounts of environmental OLs and OLOs in each country. Compared to other studies based on hashtag data, we can be sure that the selected accounts represent citizens' and organizational opinions in Belgium, France, and Norway.

4.2.2 Multimodal corpora collection from Instagram and its adaptation

The focus of this section lies within the process of collecting multimodal corpus from Instagram and adapting it for the research objectives. We follow the definition of a corpus proposed by Barthes (1967, p. 96) as "a finite collection of materials, which is determined in advance by the analyst, with (inevitable) arbitrariness, and on which he is going to work." In the research field on social media, the materials for the analysis can be user profiles, posts, or the visual or verbal components of a post. By visual components, hereafter referred to as visuals, we understand the still and moving images whose roles are significant within the messages in a particular social media platform.

Before collecting data from Instagram, we developed a list of objects that should be obtained for each account. They included images, videos, and texts posted by the account, the metadata of the account, and the posts' metadata. Regarding the platform's affordances at different stages of its development, the metadata of an Instagram account can include the number of followers, the number of followees, the date of the account's creation, and the type of account (business/personal).

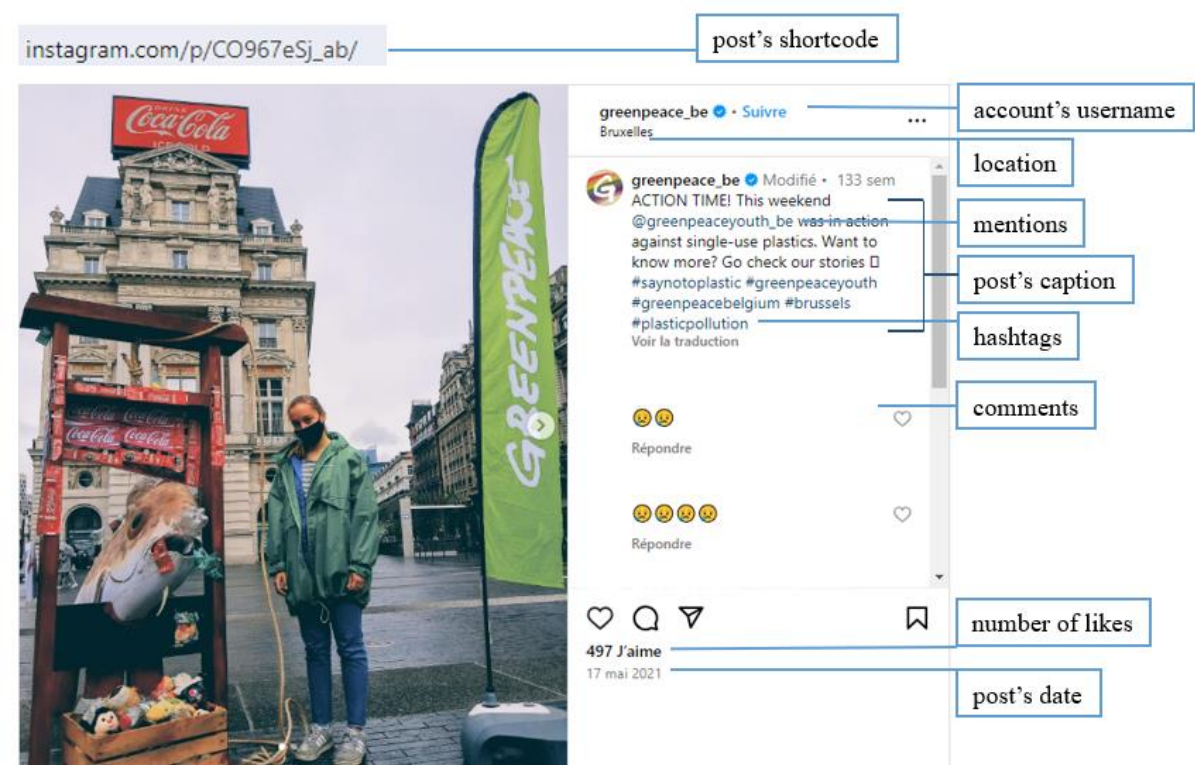


Figure 9 A scheme of an Instagram post accessed via a web browser

The metadata related to an Instagram post can include the number of likes, the number of comments, the number of views, the number of shares, the engagement rate, the date and time of the post, location, mentioned accounts, mentioned hashtags, the URL of the post, the shortcode of the post, the user ID or username. This information is usually provided on the post's page if the user gives access to this data. An example of different metadata of an Instagram post is illustrated by Greenpeace's post in Figure 9. In the following section, we delineate the existing tools that can be used to collect media files and metadata from posts on Instagram.

4.2.2.1 Instagram posts: methods for retrieving the data

In June 2020, the official Instagram API was disabled for public use. The researchers, working with Instagram data, had to find alternative options for collecting Instagram posts. In this part, we present the exploratory stage of collecting data from Instagram. In particular, we closely examine several free and open-source applications, such as *CrowdTangle*, *Instaloader*, and *Post.py*, that enable to obtain Instagram posts for research purposes. Finally, we present the method chosen for the data collection for the Project.

CrowdTangle is “A tool from Meta to help follow, analyze, and report on what’s happening across social media.” Starting in 2019, CrowdTangle is now a free, open-source platform for academics and researchers working on misinformation, elections, COVID-19, racial justice, and well-being. To access the data, the researchers have to fill out an application form and justify the relevance of their project to the selected themes. The period from application to *CrowdTangle* access can take one to seven months. In our case, the application was made in May 2021, and the acceptance letter was received in December 2021. Despite the lengthy application process, *CrowdTangle* allows one to analyze an already created corpora from Facebook or Instagram accounts or Reddit lists. It also permits to build a new corpus of posts by the selected accounts from these media. *CrowdTangle* visualizes and collects such metadata as the date and the time of the post, the number of likes, comments, and the average engagement rate per post in a selected time in PDF or CSV formats. However, the images and the videos shall be collected separately as they are only visualized on the platform. Moreover, CrowdTangle visualizes and provides the collection of data at a particular time, not all posts, by an account. We did not apply this method for our data collection since the tool did not allow us to collect the comments and was not able to visualize the accounts with less than 10k followers, representing a part of our data.

Instaloader is a “tool to download pictures (or videos) along with their captions and other metadata from Instagram.” It is an open-source Python code under an MIT license on GitHub. It collects the demanded number of posts or stories of one account or a hashtag from Instagram. The images are saved in the original format. The text for each post is saved as a TXT document. The metadata for each posted image is stored in a “raw” format in a JSON document, including 376 variables. Besides, the tool generates one JSON file for each post’s metadata, complicating the metadata reading process. Due to the difficulty of reading the obtained data

and frequently appearing problems with this tool, such as blocked Instagram account used to collect data or having no access to the tool, we did not use this method for our study.

An IT specialist working on the Project developed a new tool based on *Instaloader* Python code, which we called *Post.py*. It was aimed at collecting images and videos from an Instagram account in one folder alongside the metadata to them in one Excel file. The collected metadata included the Filename of the media file, URL of the post, Post's Date/Time, Username, Followers, Engagement Rate, Like Count, Comment Count, Location, Post Type, Caption, Hashtags, Mentions, URL of the media file from the server. To reconstruct the user's behavior, *Post.py* scraped a limited number of posts per account with a waiting time of 20 to 40 seconds per request. Figure 10 illustrates the workflow of the *Post.py* code.

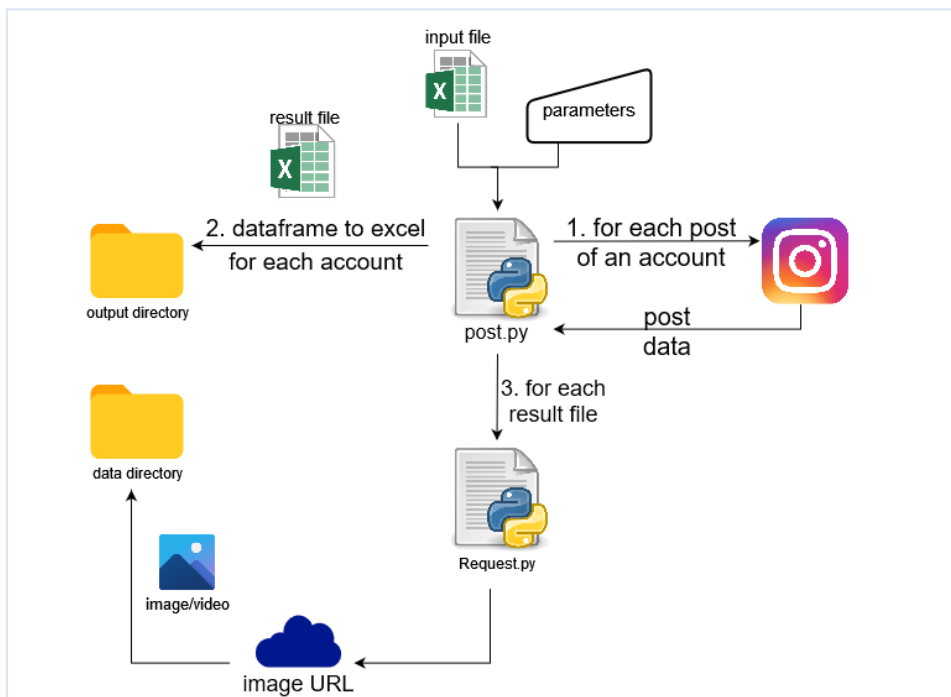


Figure 10 *Post.py* workflow

We conducted 55 collection tests with *Post.py* and observed a high number of its limitations. First, it demands the creation of a new Instagram account, which Instagram can block if it exceeds the collection of 200 posts. Second, the average time for collecting 200 posts is three hours, and there should be at least one day between the two collections. Third, the collection process can be stopped by an error, and already scraped data will not be saved. Finally, collecting data from Instagram with a *Post.py* code is a demanding process, and it can take a

long time to collect the publications from more than a hundred accounts. Due to the abovementioned limitations and the timeframe of the Project, we did not utilize this method.

In the context of our research project and its timeframe (2020–2024), we chose an alternative way of collecting Instagram data, which was a three-step method. First, the metadata of the posts was obtained using *Vurku PRO* services. Second, image files were collected with the help of *ImageDownloader*. Third, we collected comments to these posts with a tool developed in collaboration with BeCode.

(1) According to the information on their website, “Vurku is an Instagram Post Downloader! It was created as a personal tool, and later opened up to public as it was found to be an incredibly useful tool in managing and promoting instagram accounts”⁹. The website Vurku provided three options for yearly and monthly plans: from Lite (0\$ a month, billed yearly) to PRO (24.99\$ a month, billed yearly). Whereas the Lite yearly plan allowed the collection of only 50 posts from 50 accounts a month, the PRO yearly plan provided an unlimited number of collections of up to 500 most recent Instagram posts from one account or posts, including a particular hashtag. Figure 11 represents the page dedicated to data collection from Instagram. For the Project, we utilized a PRO yearly billed Vurku account.



Figure 11 Vurku scraping page

⁹ <https://vurku.com/>

Instagram scraping with *Vurku* PRO allowed us to collect the following metadata of the posts: Filename From Zip, Source URL, Post Date/Time, Username, Followers, Engagement Rate, Like Count, Comment Count, Location, Post Type, Caption, Hashtags, Mentions, Image/Video URL. The principles of data collection were not mentioned on *Vurku*'s official website. The collected metadata was stored in an Excel file, which is named automatically "post-data-scraped-by-vurku.xlsx." The name of the *Vurku*-generated Excel file was further changed by a researcher in order to guarantee easy access to the information. The files containing metadata for usernames were renamed as "abc_username," where "abc" is the username requested from *Vurku*, and "_username" is the extension to provide the type of the request – username. The files, including the metadata for hashtags, were renamed as "def_hashtag," where "def" – the hashtag requested from *Vurku*, and the extension "_hashtag" showed the type of the request – the hashtag. The images and the videos cannot be collected automatically from *Vurku* alongside the Excel file. Nevertheless, the media files could be separately collected from the website, see Figure 12.

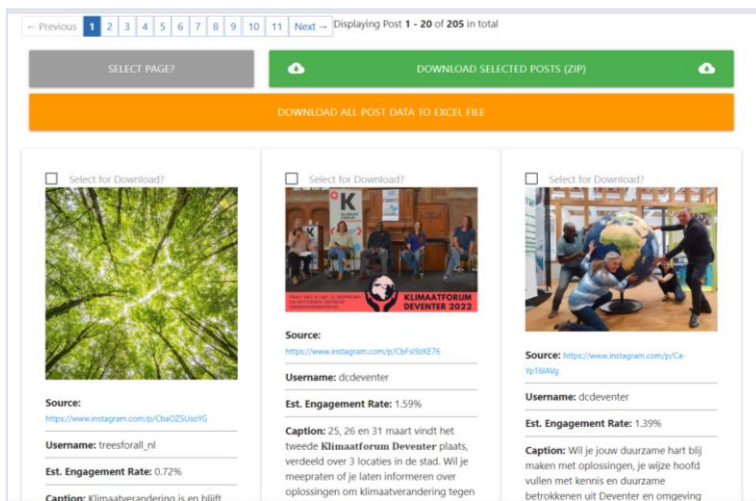


Figure 12 Collected images screenshot

As shown in Figure 12, the images from *Vurku* shall be collected separately, either one by one or by sets of 20 images in one zip archive, which makes data collection a long and complicated process. To easily and more rapidly collect the images from *Vurku*, an IT specialist working on the project developed a Python code, which we named *ImageDownloader*.

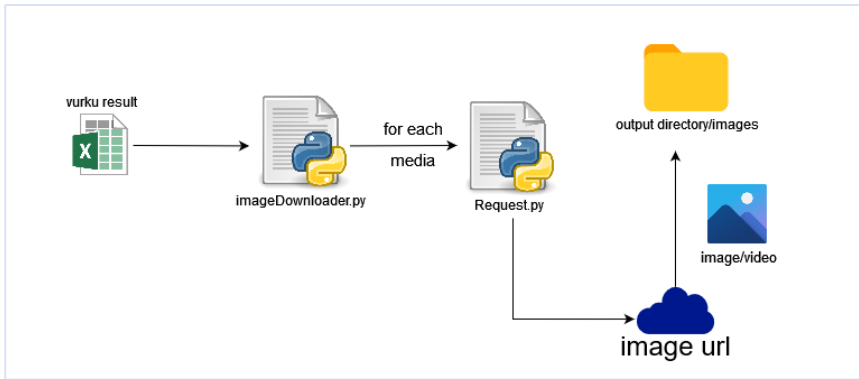


Figure 13 *ImageDownloader* workflow

(2) The *ImageDownloader* code allowed us to obtain all multimedia files (images and videos) from the Excel file created by Vurku. Given an Excel file with a column of the post's name and a column with the URL of the image/video of the post, *ImageDownloader* saved the content automatically in the newly created folder – output directory, whose name corresponded to the Excel file. In case of failure, an Excel log file was created containing the name of the post and the URL of the content that could not be scrapped. To evade errors, we recommended running the *ImageDownloader* code no later than 24 hours after the Vurku collection was completed. Figure 13 represents the described scheme for collecting images.

(3) To obtain the comments' texts to the collected Instagram posts, we collaborated with data scientists from *Becode* Belgium¹⁰, an organization that provides training in computer science. The students from *Becode* developed a user-friendly software to collect comments from Instagram. The program used *Selenium* (an open-source tool to scrape data from websites automatically) and Fast API (a web framework to build an API) to collect the data. Given a list of links to Instagram posts, the software obtained comment texts, username IDs of the comments' authors, and the date and the time of the comment posted. The output data was stored in a JSON file. The software is posted on Git Hub and is available for researchers (<https://github.com/AhmetSmlCicek/UCL-Research-Project>).

To summarize, efficient data collection from Instagram is still a developing process. In this part, we presented three possible methods that could be applied to collect Instagram posts

¹⁰ <https://becode.org/>

from publicly open accounts: *CrowdTangle*, *Instaloader*, and *Post.py*. However, they represented significant limitations during data collection, such as limited access to the tool, constant blocking of the Instagram account used to scrape the data, and unavailability of the tool for unknown reasons. Considering the limitations of each method, the data for the Project was obtained with the help of *Vurku*, *ImageDownloader*, and *Becode*'s developed tool. This process was thoroughly documented, and the document can be accessed by demand. The posts' data collection started on 13.08.2021 and was completed on 05.04.2022. Overall, we ran 429 collection tests during this period, and 265 tests ended with an error. The errors resulted from the work on *Vurku* servers, problems with getting information from Instagram servers, and the problems associated with accessing the links in the Excel file generated by *Vurku*. More details about the abovementioned errors will be further evaluated in Section 8.2.1 *Limitations of corpora selection and data collection*.

As a result of the data collection process, a multimodal corpus was constructed according to the project's needs: metadata and media files of the multimodal posts by environmental OLs and OLOs from Instagram, and the comments to the collected posts. The following section describes the collected data and a selected corpus for further analyses.

4.2.2.2 Collected corpus of Instagram posts

The corpus of Instagram posts incorporates 70 accounts of environmental OLs and 50 accounts of environmental OLOs. For the project, we collected 13047 posts by OLs, which include 20458 images and 1949 videos. The collected subcorpus of OLOs gathers 9835 posts comprising 16599 images and 1441 videos. The posts' metadata for each account are stored separately in 120 CSV files. (See Table 4).

Table 4 Collected Instagram posts (numbers of units)

	POSTS	IMAGES	VIDEOS
OLS	13047	20458	1949
OLOS	9835	16599	1441
TOTAL	22882	37057	3390

The corpus of environmental OLOs does not require anonymization, and its metadata is published on the *UCLouvain Dataverse* platform by Samofalova et al. (2022b). In order to

correspond to the ethical requirements of the project, the corpus of posts by environmental OLs was fully pseudonymized and published on the Dataverse by Samofalova et al. (2022a). The media files for each subcorpus can be accessed by demand.

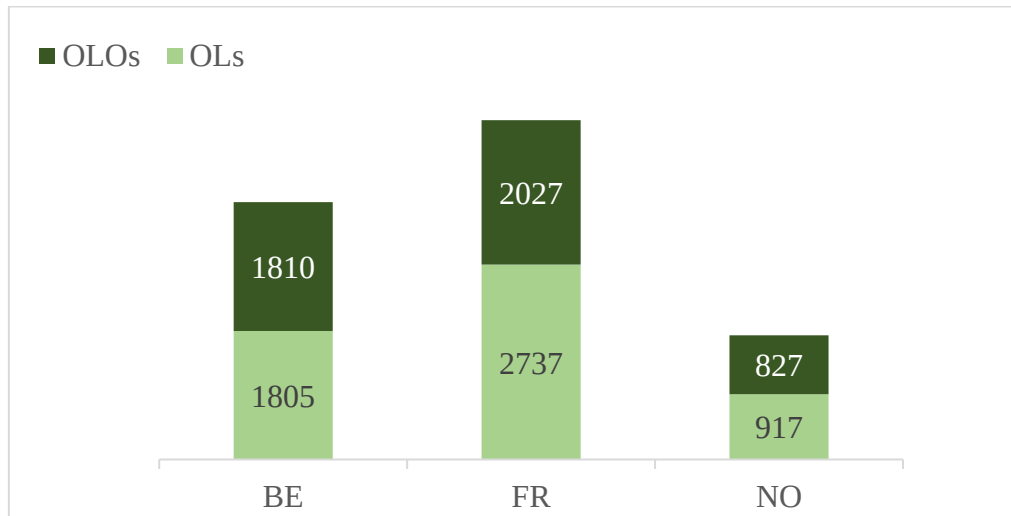
Altogether, the single platform corpus comprises 37057 images and 3390 videos, which corresponds to 23363 posts from 120 accounts between 2012 and 2022 (Table 4). However, the time period for all selected accounts covers 01.01.2021 – 31.03.2022. In this context, to guarantee a homogenous corpus for data analysis, we used this timeframe: 01.01.2021–31.03.2022. This subcorpus represents **the main corpus of this research** and is further called *Corpus21-22*. The *Corpus21-22* is represented by 10123 posts by OLs and OLOs, with 17472 images and 1890 videos. In addition, we collected 22608 comments to the posts. It should be noted that the program could not collect all the comments due to some restrictions, which will be further discussed in Section 8.2.1 *Limitations of corpora selection and data collection*. Table 5 visualizes the detailed numbers of collected data.

Table 5 *Corpus21-22, numbers of collected data*

	Posts	Images	Videos	Comments
OLs	Sum: 5459	Sum: 9312	Sum: 1219	Sum: 16300
<i>BE</i>	1805	2718	332	1145
<i>FR</i>	2737	5228	714	12341
<i>NO</i>	917	1366	173	2814
OLOs	Sum: 4664	Sum: 8671	Sum: 709	Sum: 6308
<i>BE</i>	1810	2784	276	1188
<i>FR</i>	2027	4514	287	4344
<i>NO</i>	827	1373	146	776
Total	10123	17983	1928	22608

The 10123 collected posts represent the data for environmental OLs and OLOs in the three countries of the project: Belgium, France, and Norway. The *Corpus21-22* includes 3615 Belgian posts, 4764 French posts, and 1744 Norwegian posts. Table 6 details the selected data.

Table 6 Corpus21-22, posts by country and enunciator



In addition to the provided statistics about the number of posts for each country in *Corpus21-22*, we introduce the statistics related to the number of collected media files. As introduced by Table 5, the still images are prevalent in the *Corpus21-22*. Furthermore, Table 7 provides a detailed representation of media files in *Corpus21-22*, according to the type of account and country. It also shows that both OLs and OLOs prefer posting still images on their Instagram accounts. Despite this, individual environmental OLs in our corpus tend to post more video content than organizations.

Table 7 Images and videos in Corpus21-22, according to the type of account and country

Accounts	Number of images (%)	Number of videos (%)	Total (%)
OL BE	2718 (89,11%)	332 (10,87%)	3050 (100%)
OLO BE	2784 (90,98%)	276 (9,02%)	3060 (100%)
OL FR	5228 (87,98%)	714 (12,02%)	5942 (100%)
OLO FR	4514 (94,02%)	287 (5,98%)	4801 (100%)
OL NO	1366 (88,76%)	173 (11,24%)	1539 (100%)
OLO NO	1373 (90,39%)	146 (9,61%)	1519 (100%)

As shown in Table 6 and Table 7, the data collected from the accounts of Belgian and French OLs and OLOs is almost evenly distributed with a slight prevalence of French data. This can be explained by the higher number of selected accounts for French OLs and OLOs. However,

the Norwegian data is underrepresented in the *Corpus21-22*. This underrepresentation is directly linked to the smaller number of selected Norwegian accounts.

To recapitulate, at the data collection stage, we obtained Instagram posts from the accounts of Belgian, French, and Norwegian environmental OLs and OLOs. Due to the limitations of *Vurku* and the *Becode* provided tool, we were not able to obtain all posts by the selected accounts. However, we collected most of the data posted by the selected environmental OLs and OLOs accounts between January 2021 and March 2022. Thus, the collected corpus is not exhaustive, which is one of the limitations of this study. This and other limitations regarding the data selection and collection are discussed in detail in Section 8.2.1. Finally, the obtained data was adapted to the practical formats and cleaned for further manipulations.

4.2.2.3 Data processing

To better organize the data analysis process, we organized the data in the necessary formats. All JSON and CSV files were transformed into XLSX format with the import data function in Excel since this format is convenient for the analysis tool *MaxQDA*. From these files, we deleted duplicate lines for each account since they represent the collected media files, not posts; thus, in the final version of Excel files with metadata, the metadata represents the whole post. Image and video URLs were also deleted from the Excel files since they represent temporary metadata available only for 30 days after data collection.

To prepare comment data for further sentiment analysis, we deleted mentions of other accounts and links from the comments' texts using *TEXTSPLIT* and *TEXTJOIN* functions in Excel. We did so because mentions and links do not possess any emotional function. We also manually deleted the comments in the languages not recognized by the analysis tool. Our focus languages are Dutch, English, French, and Norwegian. The data in each language was stored in separate files. These manipulations provided clear and more practical data, which can be more effectively analyzed with the help of automatic tools.

4.2.3 Ethical requirements and considerations

Research on digital content, such as social media platforms, is nearly always related to human subjects. In order to respect ethical protocols, notably the General Data Protection Regulation

(hereafter GDPR)¹¹, researchers need to differentiate between what is public and private, what content users leave on Instagram or not, what is reusable for academic purposes, and what is not. On different platforms, different rules and social codes apply, where definitions of privacy are applied in different ways (Lindgren & Eriksson Krutrök, 2024), for instance, based on the legal rules of the company's headquarters country.

Ethical requirements regarding Instagram data involve three main challenges. First, not all Instagram users provide their approval for public consultation and hide their content from a non-approved community. In this study, we did not select such accounts: all collected data was obtained from publicly open accounts of environmental OLs and OLOs. Second, Instagram does not claim ownership of the posted photos and videos but has a license to use them. As they write on their website:

“When you share, post, or upload content that is covered by intellectual property rights (like photos or videos) on or in connection with our Service, you hereby grant to us a non-exclusive, royalty-free, **transferable, sub-licensable**, worldwide license to host, use, distribute, modify, run, copy, publicly perform or display, translate, and create derivative works of your content” (Instagram, 2024).

Under this license, Instagram has the right to the posted photos if individuals accept Instagram's terms of use, which allows scholars to use the media files and metadata to them.

Lastly, Instagram users' privacy is protected by the GDPR and the collected data needed further processing, such as pseudonymization. We pseudonymized the data obtained from the accounts of individuals. Each account was given a random 6-character pseudonym, which could include random numbers from 0 to 9 and random letters from A to Z. The pseudonyms were generated automatically with the help of the *Short Unique ID (UUID)* generating library. The library is an open-source code available at <https://shortunique.id/>. The pseudonyms for each username are stored in a separate Excel file protected by a password that only knows one project researcher. The metadata in Excel files was renamed according to each pseudonym. The media files were renamed automatically with the help of Ant Renamer¹² – an open-source tool that allows the renaming of large amounts of data according to a pre-defined criterion.

¹¹ <https://gdpr-info.eu/>

¹² <https://antp.be/software/renamer/fr>

The data from the accounts of organizations or public figures presented in the thesis is not pseudonymized for easier access to the content during the presentation of the results. However, pseudonymization or anonymization will be considered when publishing the thesis as a manuscript or a set of academic articles. All necessary permissions to publish visual data will be obtained prior to publishing.

4.3 Research methodology

In this research, we adopted a mixed-method research design to analyze the posts by environmental OLs and OLOs in Belgium, France, and Norway. We combined different “manual” quantitative and qualitative methods with several automated approaches. Figure 14 illustrates the scheme of the analysis.

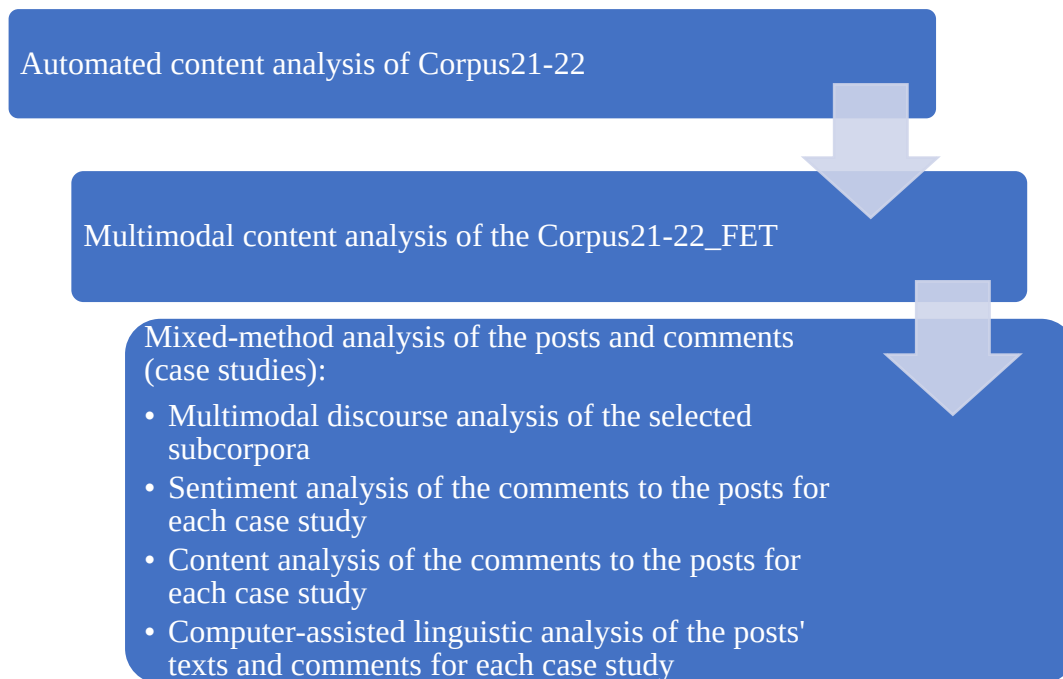


Figure 14 Research design

First, we automatically selected posts considering the food, energy, and transport themes with the help of an automated labeling function of *MaxQDA* (cf. 4.3.1 Automated content analysis); we called this subcorpus *Corpus21-22_FET*. Second, we developed a codebook for the multimodal content analysis of the posts selected at the previous stage. The analysis process is discussed in Section 4.3.2 *Multimodal content analysis: codebook and procedure*. Chapters 5–

6 demonstrate the results obtained with the multimodal content analysis. Third, we selected four subcorpora for mixed-method case studies based on the number of posts containing obstacles. This mixed-method approach comprised a qualitative multimodal discourse analysis combined with computer-assisted linguistic observations of the posts, sentiment analysis, content analysis, and computer-assisted linguistic analysis of the comments. The detailed procedure of the mixed-method approach to the case studies is provided in part 4.3.3 *Case studies' analyses: a mixed-method approach*. We discuss the results of the case studies in Chapter 7 *Mixed-method case studies*.

4.3.1 Automated content analysis

As described in part 4.2.2.2 *Collected corpus of Instagram posts, Corpus21-22* – the data corresponding to the period between January 2021 and March 2022 – represents the main corpus for our analysis. The corpus incorporates 10123 posts by Belgian, French, and Norwegian environmental OLs and OLOs, which may or may not discuss the themes of our interest, i.e., **food**, **energy**, and **transport**.

To optimize the following multimodal content analysis, we applied an automated content analysis of the posts' texts to identify the posts related to the three themes. We did so by creating **a set of dictionaries**, which were further used by the *MaxQDA* tool to label the posts according to the specific theme. For example, the dictionary of food terms in English included such words as *pesticide, agriculture, drought, overfishing, CAP, permaculture, compost, meat, vegetable, fruit, garden, organic product, food, eat, feed, vegetarian, vegan*. All posts' texts that included at least one of the words from this dictionary were labeled as the "food" theme by *MaxQDA*. We followed the same procedure with other dictionaries that we developed: food in Dutch, French, and Norwegian languages, energy in Dutch, English, French, and Norwegian, and transport in Dutch, English, French, and Norwegian. The choice of languages resulted from the languages of the countries of focus and the collected posts. The complete dictionaries are presented in Appendix 2 *Multilingual dictionaries for automatic content analysis*.

As a result of this annotation, we obtained 2092 posts by environmental OLs and OLOs from Belgium (N = 685), France (N = 1143), and Norway (N = 264). The detailed statistics for each subcorpus are pictured in Figure 15. This method allowed us to contextualize the data around our research questions and gain time during data analysis.

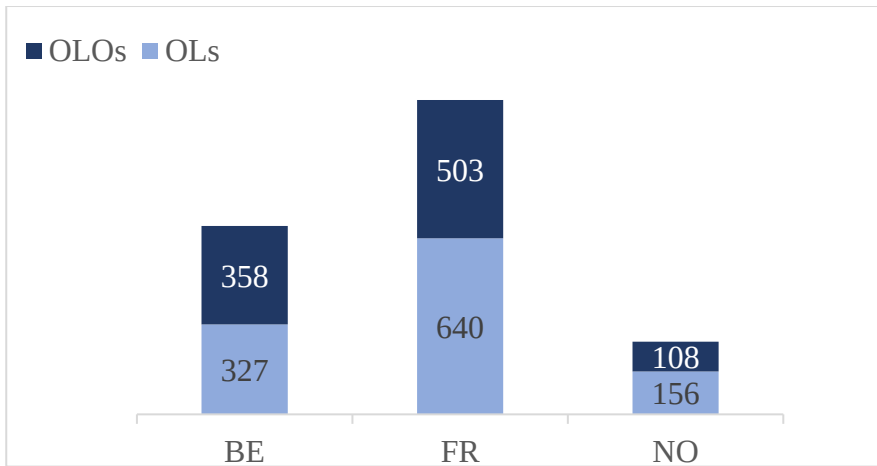


Figure 15 Corpus 21-22 after automated content analysis

For further convenience, we will call the subcorpus containing the posts about food, energy, and transport themes in the three countries *Corpus21-22_FET*. It should be noted that an automated analysis of the posts with the *MaxQDA* tool was possible only on the posts' texts: The images and videos were not considered for this type of annotation. This may represent a possible limitation of this method and will be further discussed in part 8.2.2 *Limitations of data analyses*. However, we addressed the images and videos when conducting multimodal content analysis and multimodal discourse analysis.

4.3.2 Multimodal content analysis: codebook and procedure

As discussed in part 3.2.1 *Content analysis*, multimodal content analysis can be employed in environmental communication research. Accordingly, in this present study, we developed a preliminary analysis grid regarding our **contributory research questions**:

- 1) What are the tendencies in Instagram posts by environmental OLs and OLOs concerning climate actions in the three sectors?
 - 1.1) Which climate actions related to solutions to CC mitigation are represented in the posts?
 - 1.2) Which actors are represented as responsible for CC mitigation?
 - 1.3) Which obstacles to pro-environmental action are represented in the posts?
 - 1.4) Which environmental values are represented in the posts?
 - 1.5) Which values appear in relation to the identified obstacles to pro-environmental behavior?

The initial codebook included 11 questions, or variables, divided into **four categories: CC themes, Climate actions and actors, Obstacles, and Values**. Each category was related to one or two contributory research questions:

1. The category *CC themes* aimed to identify the main themes within the analyzed post. It involved questions such as: (1) *Is the post related to climate change or environmental topics?* and (2) *Which theme is present in the message?* (3) *If you chose Food/Energy/Transport theme in Question 2, which sub-theme is mentioned in the post?*
2. The category *Climate actions and actors* was focused on the main pro-environmental actions that are taken by individuals, institutions, or organizations, as well as the actors criticized for their irresponsible behavior, i.e., or villains as from the simplified narrative structure proposed by Gjerstad and Fløttum (2021), and the actors responsible for CC mitigation, in other words, heroes from simplified narrative structure proposed by Gjerstad and Fløttum (2021). It comprised four questions, i.e., (4) *Which climate actions related to solutions to CC mitigation are represented in Instagram posts?* (5) *Which type of climate action, individual or group, related to solutions to CC mitigation is represented in Instagram posts?* (6) *Which type of climate action, global or local, related to solutions to mitigation regarding geographical aspects is represented in Instagram posts?* (7) *Which actors are represented as responsible for CC mitigation?*
3. The category *Obstacles* referred to the barriers negatively affecting pro-environmental action, demotivating people to act, or causing interference. These obstacles could be directly expressed by the enunciators or implicitly appear in the text or the visual. It encompassed two questions: (8) *Which obstacles to CC mitigation are represented?* and (9) *Who/what is criticized in the post for not contributing to CC mitigation?*
4. The *Values* category was adapted from the environmental values developed by Bouman et al. (2018; 2021) and described in detail in Section 1.1.1 *Climate change mitigation and environmental values*. It included two questions: (10) *Which environmental values are represented in the posts?* (11) *How is an environmental value presented regarding the environmental value items proposed by (Steg, Perlaviciute, et al., 2014)?*

Questions 1, 2, 5, 6, 10, and 11 were close-ended, while questions 3, 4, 7, 8, and 9 were open-ended. The details of the proposed replies to each question and the preliminary codebook are proposed in Appendix 3 *Preliminary codebook for multimodal content analysis*. While questions 1, 2, 5, and 6 cannot present any difficulty during the encoding process, questions 10

and 11 should be specified since they deal with complex notions of values, which might sometimes be ambivalent.

Differences between each category of values applied in the preliminary codebook need to be specified:

- The **biospheric value cluster** concerns care for nature and the environment and includes the following items: preventing pollution, protecting the environment, respecting the Earth, and unity with nature. *Preventing pollution* means the importance of preventing environmental pollution and protecting natural resources, which can be expressed by the necessity to reduce carbon emissions or the desire to have access to fresh air. *Protecting the environment* is related to nature preservation and the importance of protecting the environment. It can be visualized by the image of saving animals or by mentioning the necessity to protect particular species in the text. *Respecting the Earth* signifies being in harmony with other species and respecting nature. It may also refer to the harmony between nature and indigenous communities. *Unity with nature* can be explained as fitting into nature and the importance of being one whole with it.
- The **altruistic value cluster** can be explained by caring about other people and societies. It incorporated five value items: equality, social justice 1, social justice 2, a world at peace, and helpful. *Equality* value item represents equal opportunity for all people, i.e., the importance for every person to have equal opportunities. *Social justice 1* embodies treating every person in an equal manner or correcting injustice. *Social justice 2* illustrates care for weak people, such as helping people who are worse off. *A world at peace* represents the importance of the absence of wars and conflicts. *Helpful* value item means working for the welfare of others and the importance of being helpful.
- The **hedonic value cluster** focuses on pleasure and the desire to have fun or to express positive emotions. It includes three value items: pleasure, enjoying life, and self-indulgent. *Pleasure* value item relates to the gratification of desires and the importance of having fun, which can be expressed by smiling pictures and accompanied by joyful text. *Enjoying life* means the importance of enjoying life's pleasures, such as food, sex, or leisure. *Self-indulgent* value item covers the importance of doing things that people enjoy.
- The **egoistic value cluster** concerns personal resources and the desire to contribute to them or augment them. This cluster comprises five value items: social power, authority,

influence, wealth, and ambition. *Social power* means the importance of having control over other people's actions. It is more frequently referred to as the social power transmitted by companies, organizations, or even scientists, who have a certain level of expertise and can, therefore, guide others. *Authority* represents the right to command and lead and the importance for someone to have authority over others. This value item can be related to the authority that political leaders possess. *Influential* value item shows the importance of having an impact on people and events, promoting something, and influencing consumer behavior. *Wealth* value item considers material possessions, such as money, a personal car, a house, or even an airplane. *Ambitious* value item reflects the necessity to work hard, be ambitious, and achieve one's goals.

The unit of analysis for multimodal content analysis was an Instagram post – a visual with accompanying text to it. We observed the post as a whole, an image first, as it is the predominant element of an Instagram post, caption – second, and answered the questions from coding categories (Appendix 3 *Preliminary codebook for multimodal content analysis*).

Answers to each question were encoded in the *MaxQDA* tool. An illustration of such encoding is provided in Figure 16. On the left side of the screenshot, the coder accessed the documents related to each account and created codes regarding the 11 coding categories, attributing distinct colors to each code. The right side of the software is dedicated to the text of the post linked with the visuals, which can be annotated according to pre-defined coding categories from the left side. The researcher highlighted the answer in the text, whether the answer to the question appeared in the caption. If the answer appeared in the visual, the researcher highlighted the link to the visual, which is accessible in the tool. The use of this software allowed the researcher in charge to encode the essential elements, which helped answer the research questions, count and visualize the frequencies of each encoded element, and easily access the saved answers after encoding.

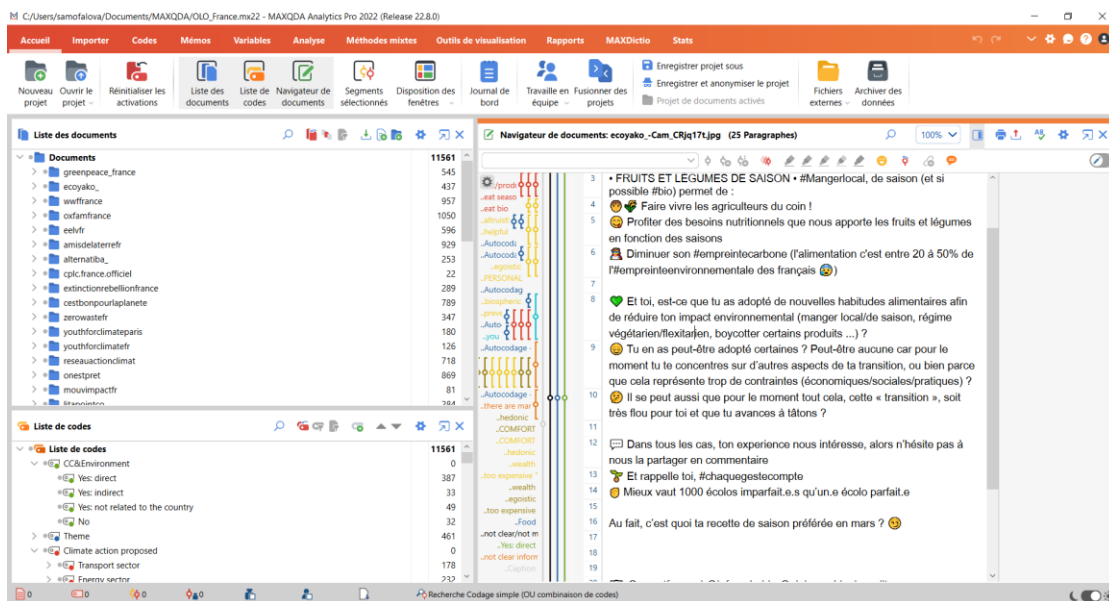


Figure 16 Encoding example of Instagram posts

The preliminary codebook was pre-tested on the data from the Instagram accounts Youth for Climate, a branch of the Fridays For Future youth climate movement present in France and Belgium. The results from this analysis were presented at the international cross-disciplinary conference *Living with Climate Change* (Bergen, Norway) and will be published in a *Routledge Handbook of Grassroots Climate Activism* (Samofalova et al., forthcoming).

Following the preliminary codebook's testing phase, some questions from 11 coding categories were omitted, one question was added, and some values to the proposed variables were modified according to the analyzed data. For example, Questions 5 and 6 about global vs. local and individual vs. collective actions were removed from the main codebook used to analyze the *Corpus21-22_FET*. The main reason for this was possible redundancy with Question 4. The removal of this question would not influence the results of the encoding. If necessary, the answers to Question 4 can be further analytically deduced into global/local or individual/group actions.

Another modification to the analysis grid was applied following the category of values. First, we added a new question: *Which environmental values and value clusters are related to the identified obstacles in the post, based on the environmental value items proposed by Steg et al. (2014)?* The suggested coding values for this variable question were similar to the answers to Question 11. Then, we united *social justice 1* and *social justice 2* value items since they were more frequently used together in the analyzed posts, and therefore, they can be summarized as

social justice. We also added the three values to the coding category related to the hedonic value cluster and one category to the egoistic value cluster, which were adapted from the universal values classification developed by Schwartz (1992). Additional categories to the hedonic value cluster included comfort, satisfaction of accomplishment, and inner harmony. We did not adopt other value items, such as tradition, face, or humility, from the typology proposed by Schwartz (1992) since they did not appear in the preliminary case study. In the added value items, *comfort* refers to the importance of being in comfortable conditions without changing personal habits, for example, not spending much time on grocery shopping because there is a small food boutique near the house. The *satisfaction of accomplishment* is related to joy and the importance of satisfaction with a completed task, such as a feeling of happiness following a vegetarian lifestyle. *Inner harmony* means the importance of being at peace with oneself. *Personal health* was another variable added to the egoistic value cluster, which can be defined as the importance of my personal health.

In addition to the modifications to our analysis grid, we observed the co-occurrence of egoistic and hedonic values in relation to the obstacles in the analyzed posts. Besides, the *Youth for Climate*'s case study demonstrated the essential role of the post's captions in identifying the obstacles. Therefore, several hypotheses for the future examination of the data emerged while validating the multimodal content analysis method by analyzing the data from Youth for Climate's accounts. These hypotheses concern mainly obstacle-value relationships and multimodal communication on Instagram.

Hypothesis 1:

The obstacles to pro-environmental behavior in both posts and comments to them will be predominantly referred to the egoistic or hedonic values.

Hypothesis 2:

The obstacles will be more clearly stated in the verbal mode of the posts, i.e., captions or text-on-image elements, on Instagram.

To summarize, multimodal content analysis was effectuated on the corpus of posts selected by an automated encoding with the help of *MaxQDA* and called *Corpus21-22_FET*. The preliminary codebook for the analysis included 11 questions and was tested on a subcorpus of posts by Youth for Climate Belgium and Youth for Climate France. This test of the analysis grid allowed us to modify certain categories of questions and the values of the responses to

them. Specifically, we removed the questions that seemed to be redundant and could be analytically deduced and expanded some environmental value items within the value clusters. This procedure allowed us to build a comprehensive codebook, which helped us address our Contributory Research Questions 1.1–1.5. In addition, two hypotheses emerged during this multimodal content analysis of the posts by Belgian and French climate activist groups. It is important to note that the researcher effectuating the analysis speaks English and French fluently. The posts in Dutch and Norwegian languages were translated with *DeepL* online translator during the data analysis process. The video content in Dutch or Norwegian included subtitles in most cases, which were translated into English to answer the research questions. Although the translation could not provide a complete picture of language use, it still allowed us to identify the answers to the research questions.

4.3.3 Case studies' analyses: a mixed-method approach

The objective of the case studies was to investigate how the themes, solutions, obstacles, and values were represented in the posts by environmental OLs and OLOs and in the comments to them. Specifically, we aimed to identify the main iconic, plastic, and linguistic signs concerning the themes, obstacles, values, and narrative roles in the analyzed posts, considering our research questions. The posts for the case studies were selected as a result of the multimodal content analysis described in the previous part. The main criterion for these posts was the **appearance of the obstacles concerning our focus themes, food, energy, and transport**. Regarding the food theme, most of the obstacles appeared in the posts by environmental OLs and OLOs in France, which discussed the adaptation of a vegetarian diet and reducing meat consumption. In the transport sector, the majority of the obstacles appeared in the posts discussing public transport and individual car use in the posts by French environmental OLs and OLOs. The most frequently appeared obstacles to the energy theme discussed the transition from fossil fuels to renewable energies in the posts by Belgian and French environmental OLs and OLOs. Since the Norwegian corpus is underrepresented in *Corpus21-22* and not many obstacles were identified in this data during the multimodal content analysis stage, this subcorpus was not considered for mixed-method case studies. Besides our case studies, other subcorpora in Belgium and France were not considered since the number of obstacles to these posts was limited. Unfortunately, this did not allow us to compare each subcorpora qualitatively. This

represents one of the limitations of data analysis and is discussed in Section 8.2.2 *Limitations of data analyses*.

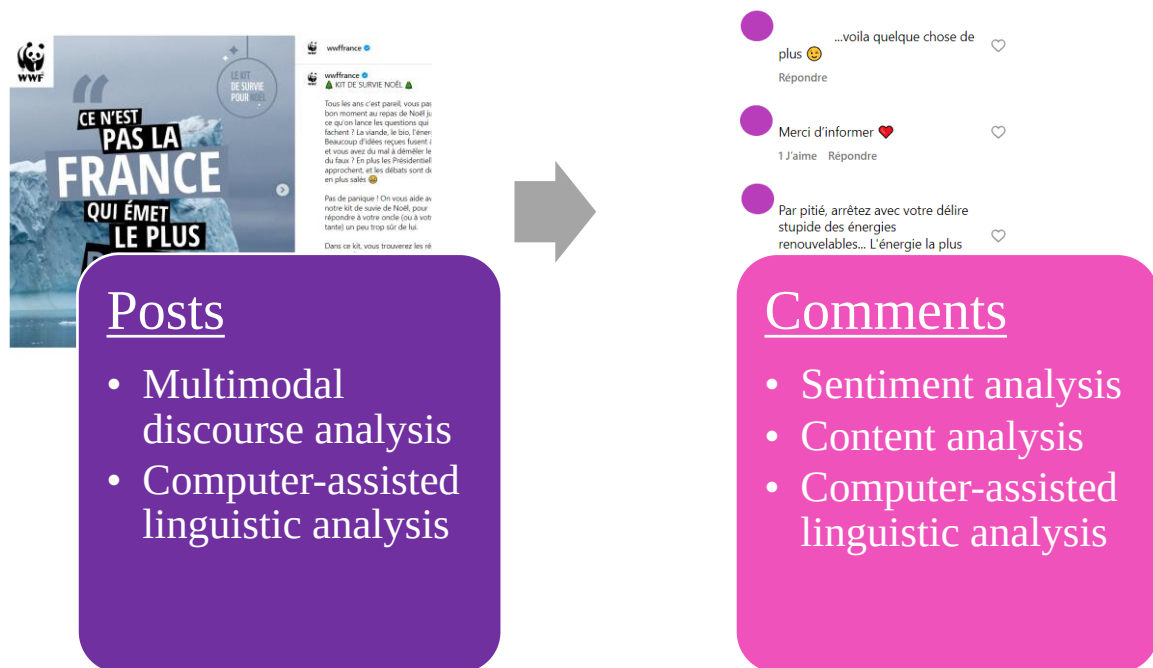


Figure 17 Case studies' research design

The mixed-method research design for the case studies included a combination of qualitative multimodal discourse analysis with computer-assisted linguistic analysis of the posts and a three-method analysis of the comments. The comments were analyzed through the prism of sentiment analysis, content analysis, and computer-assisted linguistic analysis. Figure 17 illustrates the scheme of this research design. The detailed procedures at each step of the analyses are provided in Sections 4.3.3.1–4.3.3.4.

4.3.3.1 Multimodal discourse analysis of selected posts

To assess different semiotic forms of communication, we conducted an in-depth multimodal discourse analysis of several groups of selected posts. These groups were selected according to the frequency of the posts, where the obstacles to pro-environmental action were observed concerning the selected sector. For example, the highest number of posts discussing the obstacles in the food sector was observed in the French corpus of environmental OLs (N=23) and OLOs (N=16). These posts discussed mainly meat consumption versus vegetarian or vegan

food diets and constituted a separate subcorpus, which was analyzed through the prism of multimodal discourse analysis.

The energy theme was widely discussed in Belgium and France. Therefore, two other subcorpora from *Corpus21-22_FET* were selected for the qualitative analysis: (1) the posts by Belgian environmental OLs (N=17) and OLOs (N=50) regarding the use of renewable energy sources contrary to the use of fossil fuels; (2) the posts by French environmental OLs (N=21) and OLOs (N=40) about the renewable energy sources or fossil fuels.

The transport sector was the least represented theme in our corpus: The highest number of posts mentioning the obstacles was posted by French environmental OLs (N = 10) about the individual use of cars, including electric car use versus controversies related to the use of public transport.

Unfortunately, we could not qualitatively analyze the data from the Norwegian subcorpus due to the lack of posts discussing obstacles in it.

To qualitatively analyze the selected posts from a multimodal perspective, we positioned our analysis on three questions, which are directly related to our main research question:

- (1) What is the obstacle to pro-environmental behavior present in the post, and how is it communicated in different modes?
- (2) Which environmental values are illustrated in the post? If identifiable, which environmental value is related to the observed obstacle? How are they pictured in different modes?
- (3) Who are represented as heroes, villains, and victims in the posts? How are they illustrated in different modes?

From the perspectives of multimodality developed within social semiotics, the elements of MDA's representational, interactive, and compositional meanings are included in these questions: We examine elements within each mode, their composition, and the interaction between them. Therefore, the unit of analysis is a whole post, i.e., a combination of media files and a caption. To examine these questions in greater detail, we reviewed the analysis grid by Joly and Martin (2021), which we discussed in Section 3.2.2 *Multimodal discourse analysis*, and adapted it to our data. As a result, we obtained the analysis grid that corresponded to our objectives. We provide the analysis grid in Figure 18.

Iconic signs	<i>List of iconic elements answering the following questions:</i> Who or what is present in the picture? Who or what is represented as an obstacle to pro-environmental action? Which value is represented? Who or what is represented as a hero? Who or what is represented as a villain? Who or what is represented as a victim?	First-level signification (denotation)	Second-level signification (connotation)
Plastic signs related to the obstacles, values, and narrative roles (hero/villain/victim)	Focus	Signification	
	Colors		
	Light		
Linguistic signs related to the obstacles, values, and narrative roles (hero/villain/victim)	Stylistic devices	Signification	
	Font		
	Text layout		
	Text color		

Figure 18 Multimodal discourse analysis grid

The observation of iconic signs allowed us to investigate the “what” part of our research questions, while the plastic and linguistic signs provided a detailed analysis of the “how” part of our questions. Although the iconic, plastic, and linguistic signs are distinguished in the analysis grid, we observed the relationships between them in the analyzed posts.

In the iconic signs, we explored who or what was represented in a picture in general. Specifically, we looked at who or what was represented as an obstacle, environmental value, hero, villain, and victim. In addition, we identified connotations for the observed elements where possible.

The plastic signs represented a reduced version of the analysis grid proposed by Joly and Martin and illustrated in Figure 6. They included observation of focus, colors, and light in the visuals.

Linguistic signs included observing stylistic devices, font, text layout within the images and videos, and text colors. We attribute font, text layout, and text color to the linguistic message, yet it is linked to a plastic visualization of the linguistic message.

To summarize, we qualitatively analyzed four subcorpora of *Corpus21-22_FET* about: 1) food in France, 2) transport in France, 3) energy in France, and 4) energy in Belgium. In the food sector, we analyzed the posts by OLs and OLOs regarding the adaptation of vegetarian food regimes and reducing meat consumption discussed by French opinion-leading individuals

and organizations. In the transport sector, we qualitatively analyzed the posts by individuals considering public transportation and the individual vehicle use posted by French environmental OLs. In the energy sector, we selected two subcorpora regarding the energy transition from fossil fuels to renewable energy posted by environmental OLs and OLOs in Belgium and France. Each Instagram post was addressed as a whole multimodal document, where different elements of the audio-visual, visual, and verbal modes were analyzed in relation to each other.

We did not qualitatively address emojis at this research step due to their ambiguous position in social media communication, particularly in verbal mode. On the one hand, emojis can represent elements of iconic signs demonstrating different facial expressions, abstract concepts, animals, plants, and other elements. On the other hand, emojis can be iconic representations of linguistic signs from the Unicode symbols in the text. In this context, deeply analyzing emojis would have required significant work that exceeded the limit of this thesis. Therefore, we provide several interesting examples of the use of emojis in the case studies but do not investigate this element of multimodal communication in detail.

Based on the observations from MDA of the posts, we additionally applied computer-assisted linguistic analysis of the posts' captions to visualize specific patterns and tendencies in the posts' texts. We present different functions of computer-assisted linguistic analysis in Section 4.3.3.4 *Computer-assisted analysis of the comments*.

In addition to the analyses of the posts, we conducted analyses of the comments to these posts. The procedure for the analysis of comments is provided in the next part. The results from the analyses of the posts and comments of different subcorpora considering the food, energy, and transport sectors are presented as case studies and discussed in Chapter 7 *Mixed-method case studies*.

4.3.3.2 Sentiment analysis of the comments

During the literature review phase, we identified some works that applied sentiment analysis to short texts, tweets, or comments. Research by Hodson et al. (2018) proved that skeptical messages could be identified with sentiment analysis, especially the texts identified as "negative." This method represents a particular interest in identifying skeptical messages in large corpora. Since our corpus of comments to Instagram posts includes 22608 comments, sentiment analysis at the initial stage could guide the qualitative analysis process. We conducted

a sentiment analysis of the comments to different thematic subcorpora to test our **Hypothesis 3**:

The sentiment analysis of the comments will reveal messages, including obstacles to pro-environmental behavior or skeptical comments, which will be labeled as “negative” or “mostly negative.”

The unit of analysis of this method was a comment. To effectuate sentiment analysis, we used a pre-trained multilingual *BERT* model since, unlike other methods described in Section 3.2.4, it covers the languages of the case studies, i.e., English, Dutch, and French. As indicated on the website¹³, BERT-base-multilingual-uncased-sentiment model provided by Hugging Face is under an MIT free software license. This model was finetuned for sentiment analysis on product reviews in six languages: English, Dutch, German, French, Spanish, and Italian. According to the developers, the fine-tuned model’s exact accuracy varies from 57% to 67% for the selected languages, and off-by-1 accuracy varies from 93% to 95%, which is demonstrated in Table 8.

Table 8 Accuracy scores of BERT multilingual sentiment analysis model (Source: <https://huggingface.co/nlptown/bert-base-multilingual-uncased-sentiment>)

<i>Language</i>	<i>Accuracy (exact): the exact match for the number of stars</i>	<i>Accuracy (off-by-1): is the percentage of reviews where the number of stars the model predicts differs by a maximum of 1 from the number given by the human reviewer.</i>
English	67%	95%
Dutch	57%	93%
German	61%	94%
French	59%	94%
Italian	59%	95%
Spanish	58%	95%

The comment data to the selected posts were processed row-by-row using a custom function, which employed BERT to generate sentiment labels ranging from 1 to 5. In this classification scheme, a sentiment score of 1–2 indicates negativity, a score of 3 indicates neutrality, and scores 4–5 refer to the positivity of the comment. Before conducting the analysis, the comment

¹³ <https://huggingface.co/nlptown/bert-base-multilingual-uncased-sentiment>

data was pre-processed. We deleted the duplicates within the comments to the same post by the same person, mentions, and links in the comments since they do not indicate any sentimental function.

In order to validate the use of this method, we conducted a preliminary stage of sentiment analysis on comment data to climate-related messages on Instagram. The analysis was done on a random sample of 100 comments under the posts about meat consumption and vegetarian food by French environmental OLOs. At the same time, the project researcher manually identified the comments as “negative,” “positive,” or “neutral.” Afterward, we compared the manual encoding of the posts according to three sentiments and the automatic sentiment analysis by the *BERT* multilingual model. The accuracy score was 69%. The significant differences in encodings considered the comments consisting of emojis only. 14 comments, including only emojis, such as 😞, 😔, 😓, 🙄, 😩, were annotated as “negative” by the researcher and as “positive” by the BERT model. Some examples of other mismatches are present in Table 9 below.

Table 9 Examples of mismatch between automated sentiment analysis and manual encoding by a researcher

Comment	Researcher's encoding	BERT model
Mais pas trop pour le cœur et les artères pulmonaires et cardiaque la graisse 😞😞😞 3 fois par semaine	Negative	neutral
Quel sacré fantasme entretienl le secteur depuis bien longtemps. A cause de cela beaucoup pensent toujours que Viande = Virilité 😞	Negative	positive
Le greenwashing chez McDo c'est quelquechose	Negative	Neutral
Oh la vache les arguments de merde pour convaincre de consommer...	Negative	Positive
Tu peux développer ?	Neutral	Negative

Another significant difference in encoded comments was that the comments were encoded as “negative” by the researcher and “neutral” or “positive” by the BERT model. For example, a sentence “Quel sacré fantasme entretienl le secteur depuis bien longtemps. A cause de cela beaucoup pensent toujours que Viande = Virilité 😞” was identified as “negative” by the

researcher and as “positive” by the BERT model. Although the general meaning of the sentence is negative and is accompanied by a negative emoji, we suppose that the word “virilité” has a positive connotation in the model, as well as the emoji used in the end. This mismatch could influence the identification of this sentence as “positive” by the tool.

To conclude, sentiment analysis can help researchers identify sentiments within short verbal messages. However, the accuracy of this method still represents a significant drawback to its usage. The major difficulties in identifying sentiments by an automatic sentiment analysis include the ambivalence of the meaning of emojis or the use of specific stylistic devices or wordplays, the understanding of which is not yet available for the machines. However, it can be interesting to use this method on large datasets to filter specific data where the accuracy score does not represent a significant difference. In our case, almost half of the mismatched sentiment analysis results was related to the identification of emojis. Since we aim to identify the obstacles to pro-environmental behavior in the comments, we suggest it will be difficult to identify them in the comments including a set of emojis only, due to the lack of context. In this case, sentiment analysis cannot be a relevant procedure. However, the sentiment analysis of the comments, including the texts, could provide supporting results for our Hypothesis 3. Indeed, we adopt this method to test whether the negatively labeled comments will contain obstacles. If so, this opens horizons for future research on the obstacles to CC mitigation on large-scale data from social media.

4.3.3.3 Content analysis of the comments

As stated in the title of this section, the unit of analysis at this stage was a comment. Content analysis of the comments aimed to address our contributory research questions 2.1–2.4.

- 2) How are these multimodal posts interpreted by the audiences expressing their opinions in the comments to these posts in terms of responsibilities, obstacles, and values?
 - 2.1) Who is mentioned as responsible for acting for CC mitigation in the comments?
 - 2.2) Who is criticized for their irresponsible behavior towards CC mitigation in the comments?
 - 2.3) Which obstacles to pro-environmental behavior are mentioned in the comments, and how?
 - 2.4) Which environmental values are related to the identified obstacles in the comments, and how?

To address these questions, we developed a preliminary codebook of nine questions, which was tested on a subcorpus of comments to the posts by environmental OLOs regarding the food sector. The preliminary codebook is illustrated in Appendix 5 *Preliminary codebook for content analysis of the comments*. It included eight questions, which can be divided into three categories: **Obstacles**, **Values**, and **Narrative roles**.

The category of **Obstacles** included three open-ended questions: (1) *Does the comment directly or indirectly introduce or evoke the obstacle to pro-environmental action?* (2) *If yes, illustrate the obstacle with the example phrase from the comment.* (3) *If yes, how can the obstacle be described?*

The category of **Values** incorporated two closed questions, which are similar to the Value category questions of multimodal content analysis (cf. part 4.3.2 Multimodal content analysis: codebook and procedure): (4) *Which environmental value in relation to the obstacle is present in the comment?* (5) *How is an environmental value presented, based on the environmental value items proposed by Steg et al. (2014) and Schwartz (1992)?*

The category of **Narrative roles** included three open questions, which related to a simplified narrative structure proposed by Gjerstad and Fløttum (2021): (6) *Who or what is mentioned as responsible for acting for CC mitigation in the comment (hero)?* (7) *What is represented as the villain in the comments or whose actions are irresponsible behaviors towards CC mitigation are criticized in the comment (villain)?* (8) *Who or what is mentioned as harmed in the comments (victim)?*

The preliminary codebook to content analysis of the comments was tested on a subcorpus of 516 comments to 28 posts by environmental OLOs regarding meat consumption and vegetarian or vegan food regimes. As a result of this process, the answers to Question 3 from the preliminary codebook were summarized, and 11 Obstacle categories were suggested. We modified the codebook according to this suggestion and included an additional question in the main codebook for the content analysis of the comments (Appendix 6 *Codebook for the content analysis of the comments*): *Which category of obstacle can be attributed to the observed obstacle?* The answer options comprised actions of other laypeople, actions of companies/organizations, health, choice, state authorities (in)action, stereotypes, organizing the action, money, food quality and characteristics, communication and knowledge issues, feelings, and individual conditions. In the next paragraphs, we provide a detailed description of each answer option.

Actions of other laypeople was attributed to the comment when it evoked some actions of other laypeople (except politicians and company leaders) somehow negatively interfering in the CC mitigation process and sustainable development practices.

Actions of companies/organizations means the negative influence on the CC mitigation process and sustainable development practices by companies, organizations, and their leaders.

Health – when an individual does not contribute to pro-environmental action or dissuades others from doing so due to their health conditions or the negative influence of the action on the health of the individual.

Choice – when someone refrains from a pro-environmental action because they think there are not enough options or choices proposed or because they dislike feeling compelled without being offered enough choices.

State authorities' (in) actions reflected specific actions or inactions by instances that do not contribute or are even opposed to sustainable development and CC mitigation policies.

Stereotypes were attributed when societal stereotypical opinions impacted an individual's decision not to engage in climate action, for example, the stereotype associating meat consumption with being strong and healthy men, which may be used as justification for reducing meat consumption.

Organizing the action – when various factors associated with the organization of the climate action can influence an individual's indifference to it.

Money – when an individual lacks sufficient financial resources to participate in pro-environmental action or when the cost of such action is deemed prohibitively expensive for them.

Food quality and characteristics – when an individual declines to support the transition to sustainability in the food sector because they believe that certain sustainable food practices may negatively impact food quality, taste, and other desirable characteristics.

Communication and knowledge issues – when a person does not contribute to CC mitigation because they do not possess sufficient information about it, particularly when the available information is controversial in different sources.

Feelings and individual conditions – when different personal circumstances and feelings influence an individual's decision not to participate in climate action, for example, when someone believes that his or her actions will not significantly contribute to global change.

Questions 6–8 of the codebook referring to heroes, villains, and victims are directly linked to the linguistic studies of environmental narratives in Norway based on survey data, although in a simplified form (Gjerstad & Fløttum, 2021).

Content analysis of the comments was documented in an Excel document for each selected dataset for qualitative analyses. Figure 19 illustrates the documenting process with the example from a subcorpus of comments to the posts by Belgian environmental OLs regarding the energy sphere. Column B provided a link to the post to which the comment was written. Column C was dedicated to the entire comment, and Column D was dedicated to the cleaned comment (mentions and links deleted since they do not possess any emotional characteristics). Column E showed the translation of the post to English: it was done in particular to the comments in Dutch. The comments were manually translated with the help of *DeepL*¹⁴. Columns F–G reflected the sentiment analysis results. Columns H–P were dedicated to the documentation of the answers to each question from Appendix 6 *Codebook for the content analysis of the comments*.

	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	url	comment	comment_clean	Translate BERT	BERT_sent	Obstacle	Example ph	Description of obstacle	Obstacle category	Value	Sub-category	Hero	Villain	Victim	
2	https://www.instagram.com/p/	♡♡♡♡♡	♡♡♡♡♡	♡♡♡♡♡	5 positive	no									
3	https://www.instagram.com/p/	👍👍👍	👍👍👍		5 positive	no									
4	https://www.instagram.com/p/	👍👍👍	👍👍👍		5 positive	no									
5	https://www.instagram.com/p/	👍👍👍	👍👍👍		5 positive	no									
6	https://www.instagram.com/p/	♡♡♡♡♡	♡♡♡♡♡		5 positive	no									
7	https://www.instagram.com/p/	👍👍👍	👍👍👍		5 positive	no									
8	https://www.instagram.com/p/	👍👍👍	👍👍👍		5 positive	no									
9	https://www.instagram.com/p/...	...	...		3 neutral	no									
10	https://www.instagram.com/p/	Waarom is	Waarom is	Waarom is nucleaire kernenergie nu niet in gebruik?	2 mostly neg	yes	Why is nuclear energy not being used now?	Knowledge and communication	NA	NA	NA	nuclear energy	environment		
11	https://www.instagram.com/p/	Een man in	Een man in	Een man in wording?	5 positive	no									
12	https://www.instagram.com/p/	I'll be around, I'll be around, always no need	I'll be around, I'll be around, always no need		5 positive	no									
13	https://www.instagram.com/p/	👍👍👍	👍👍👍		5 positive	no									
14	https://www.instagram.com/p/	👍	👍		5 positive	no									
15	https://www.instagram.com/p/	👍👍👍 beauty	👍👍👍 beauty		5 positive	no									
16	https://www.instagram.com/p/	Ga ervoor! Ga ervoor meid!	Ga ervoor! Ga ervoor meid!		5 positive	no									
17	https://www.instagram.com/p/	Onnozel wi Onnozel wicht	Onnozel wi Onnozel wicht		1 negative	no									
18	https://www.instagram.com/p/	Keep on fig Keep on fighting!	Keep on fig Keep on fighting!		5 positive	no									
19	https://www.instagram.com/p/	Mooi beeld Mooi beeld, Anuna. Jij denk	Mooi beeld Mooi beeld, Anuna. Jij denk		4 mostly pos	no									
20	https://www.instagram.com/p/	👍👍👍	👍👍👍		5 positive	no									
21	https://www.instagram.com/p/	👍👍👍	👍👍👍		5 positive	no									
22	https://www.instagram.com/p/	Hey Anuna, Hey Anuna, what energy we	Hey Anuna, Hey Anuna, what energy we		1 negative	no									
23	https://www.instagram.com/p/	👍👍👍	👍👍👍		5 positive	no									
24	https://www.instagram.com/p/	Thx for the Thx for the enligh no need	Thx for the Thx for the enligh no need		5 positive	yes	Thx for the money	Money	egoistic	wealth		everyone			

Figure 19 Documenting content analysis results

To recapitulate, content analysis of the comments was a complex qualitative procedure, the documentation of which allowed us to quantify certain results. The preliminary codebook for content analysis allowed us to elaborate on three essential coding categories, i.e., Obstacles,

¹⁴ <https://www.deepl.com/translator>

Values, and Narrative roles, incorporating eight questions. It was further evaluated on a subcorpus of comments to Instagram posts regarding the food sector in France. The preliminary test of the codebook for the content analysis of the comments resulted in adding one question to the category of Obstacles, which provided us with a better generalization of the analysis results. Finally, the main codebook for content analysis incorporated nine questions, which allowed us to address our contributory research questions 2.1–2.4.

4.3.3.4 Computer-assisted analysis of the comments

To complement the results from the multimodal discourse analysis of the posts and content analysis of the comments, we applied different computer-assisted analysis techniques (adopted from Corpus Linguistics or Statistical Linguistics) to specific words or phrases in some cases. These analyses were conducted in *Sketch Engine*. Sketch Engine “is the ultimate tool to explore how language works. Its algorithms analyze authentic texts of billions of words (text corpora) to identify instantly what is typical in language and what is rare, unusual, or emerging usage. It is also designed for text analysis or text mining applications”¹⁵. *Sketch Engine* proposes many functions that can be used in communication research, such as word sketch, word frequencies, n-grams, thesaurus, word sketch difference, concordance, keywords, and text type analysis. We used concordance, word sketch, and word sketch difference functions of *Sketch Engine* for our work. In the following paragraphs, we explain each function and argue our choice.

The concordance function of the *Sketch Engine* searches for specific words or phrases and presents the results in the form of “word in context,” which can be sorted, filtered, and further processed to obtain different outcomes. This function was mainly used to test inductively suggested patterns that can introduce obstacles to pro-environmental behavior in the texts. For example, we looked at the use of the conjunction “*mais*” in all subcorpora. The visualizations provided by *Sketch Engine* were clear and allowed us to confirm or infirm specific patterns.

The word sketch function processes the word’s collocates and other words surrounding the given word. The results are organized into various categories, such as modifiers of a word,

¹⁵ <https://www.sketchengine.eu/#blue>

verbs with a given word as a subject, or verbs with a given word as an object. The words included in the analysis are defined by rules written in the sketch grammar that detects potential collocations.

The word sketch difference function provides comparisons by contrasting collocations – a combination of words occurring together in the text, which can appear next to each other or at a certain distance in a sentence. Comparing collocations in different subcorpora provided important insights into the differences in using specific words and phrases. For example, in section 7.3, we observed the collocate differences between “fossil” and “renewable.” This analysis allowed us to identify the adjectives used with each word and compare their use.

Overall, we used the *Sketch Engine* to visualize certain verbal information in the corpus, to provide specific examples of the use of words, and to identify specific patterns if possible.

Chapter 4: Key elements

- The present study combined multiple research methods to identify and map different actions or solutions to CC mitigation, actors responsible for these actions and inactions, obstacles to pro-environmental actions, and environmental values in general and concerning these obstacles. In addition, we addressed how these elements were represented in four case studies.
- First, we conducted an automated multimodal content analysis of *Corpu21-22* to identify the posts regarding our focus topics, i.e., food, energy, and transport. We called the obtained subcorpus *Corpus21-22_FET*.
- Second, we analyzed *Corpus21-22_FET* with the help of multimodal content analysis by addressing four categories of questions: CC and environment, actions and actors, obstacles, and values.
- Third, after carefully observing the obstacles in the *Corpus21-22_FET*, we selected four smaller datasets for further complex mixed-method studies. These subcorpora included: 1) posts by French environmental OLs and OLOs about meat consumption and vegetarian diet, 2) posts by French environmental OLs about the use of public transport and electric vehicles, 3) posts by Belgian environmental OLs and OLOs about fossil fuels and renewable energies, and 4) posts by French environmental OLs and OLOs about fossil fuels and renewable energies.
- Finally, the case studies adopted a mixed-method research design. We analyzed posts, i.e., an ensemble of visuals and captions, and comments to them. To analyze the posts, we combined MDA with computer-assisted linguistic analysis. To analyze the comments, we used content analysis, sentiment analysis, and computer-assisted linguistic analysis.

Part 3 Results and discussions

Chapter 5 General examination of the corpus data

This chapter provides different statistical observations based on the *Corpus21-22* data. We compare the number of images and videos posted by the environmental OLs and OLOs and their engagement metrics, such as likes and comments. In addition to this, we investigate the metadata obtained for *Corpus21-22* and provide a temporal distribution of the posts and the statistics considering their use of hashtags and mentions by different enunciators. We finalize the chapter by reflecting on the observed data.

5.1 Engagement metrics and metadata of the *Corpus21-22*

In this part, we provide a general observation of the metadata related to the corpus of Instagram posts by environmental OLs and OLOs in Belgium, France, and Norway, which are stored under the name *Corpus21-22*. As stated in part 4.2.2.2 *Collected corpus of Instagram posts*, the total number of posts to analyze is 10123, including 3615 Belgian posts, 4764 French posts, and 1744 Norwegian posts. We first examine the corpus data by environmental OLs and then describe the corpus by environmental OLOs.

The environmental OLs in our corpus are represented by politicians, activists, representatives of creative professions, and people who combine one or several creative professions with activism. We attributed the category *Politicians* to the individuals whose principal activity is linked to politics, government, or local administration. The category *Activist* included the accounts of individuals whose main activity is related to social or environmental activism. Representatives of the *Creative professions* category exercise different professions demanding creative skills, such as actors, artists, bloggers, influencers, writers, journalists, photographers, and business owners. The last category, *Creative profession/activist* incorporates people who maintain different principal activities within the *Creative professions* and *Activist* categories. Table 10 illustrates different metadata concerning the groups of accounts by the environmental OLs in the three countries.

Table 10 Groups of environmental OLs within the Corpus21-22

Type of account		Number of accounts	Number of posts in Corpus21-22	Number of images	Number of videos	Number of comments
Politician		24	1945	2912	308	2221
	BE	10	958	1406	125	415
	FR	7	564	910	135	1225
	NO	7	423	596	48	581
Activist		6	399	622	76	246
	BE	5	330	525	64	215
	FR	1	69	97	12	31
	NO	0	0	0	0	0
Creative profession		33	2512	4403	642	10130
	BE	6	331	443	80	257
	FR	20	1687	3190	437	7640
	NO	7	494	770	125	2233
Creative profession/activist		10	603	1375	193	3703
	BE	4	186	344	63	258
	FR	6	417	1031	130	3445
	NO	0	0	0	0	0

As we can see from Table 10, the group of environmental OLs is represented mainly by *Creative professions* and *Politicians*. The categories of *Creative professions/Activists* are the least represented in *Corpus21-22*. In the Norwegian data, a small number of *Creative profession/Activist* and *Activist* groups are directly related to the number of observed and selected accounts, which is relatively small compared to other countries in the corpus. In France, a relatively low number of activists can also be explained by an unwillingness of individuals to designate themselves as activists. Indeed, it is very complicated or even impossible to identify the leaders of the youth climate movement in France, while in Belgium, the leaders of the youth climate movement and activists are more frequently self-designated (Samofalova et al., forthcoming).

In Belgium, the accounts of environmental OLs with the highest numbers of followers are represented by Vinz Kanté (54,2k followers), a creator, DJ, and founder of Limit Media. In France, the most followed account by an individual is the account of Lucie Lucas (487k followers), an actress and comedian engaged largely in environmental activism. In Norway, the account by Gunhild A. Stordaelen (194k followers), a doctor, environmentalist, and business owner, is the most followed in our data.

To understand which groups of accounts of individuals post more still images or videos, we calculated the mean numbers of images and videos per post. Figure 20 shows that the groups

Creative profession/activist and *Creative profession* tended to post more visual content in *Corpus21-22*. Specifically, the accounts from the *Creative profession/activist* group in France posted, on average, 2,5 images per post; in Belgium – almost two images. French *Politicians* tended to post slightly more visual content than *Politicians* from Belgium and Norway in our corpus. Belgian *Activists* posted a few more images and videos than the activists in the other two countries. On the contrary, *Politicians* preferred to post less visual content and almost avoided video formats.

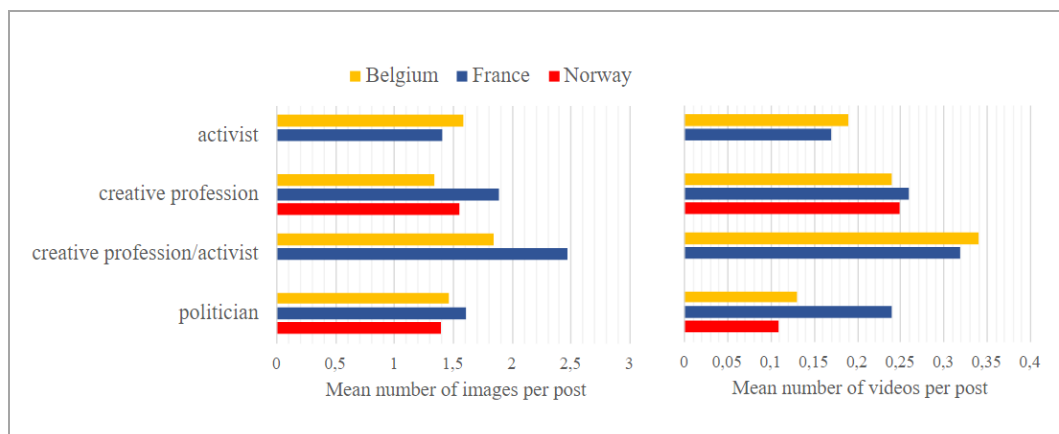


Figure 20 Mean numbers of images and videos per post by different groups of environmental OLs

Regarding the popularity of the posts in *Corpus21-22*, the posts by people representing *Creative professions/activist* group in France gained more likes to their posts in general, which can be explained by the presence of several macro influencers who pursue environmental activism in this subcorpus. Although *Politicians* is the most represented category in the Belgian subcorpus of posts by individuals, the most frequently liked posts are the posts by *Activists*. In Norway, the audiences tended to like the posts by *Creative professions*. The average numbers of likes in relation to the type of individual enunciator are presented in Figure 21.

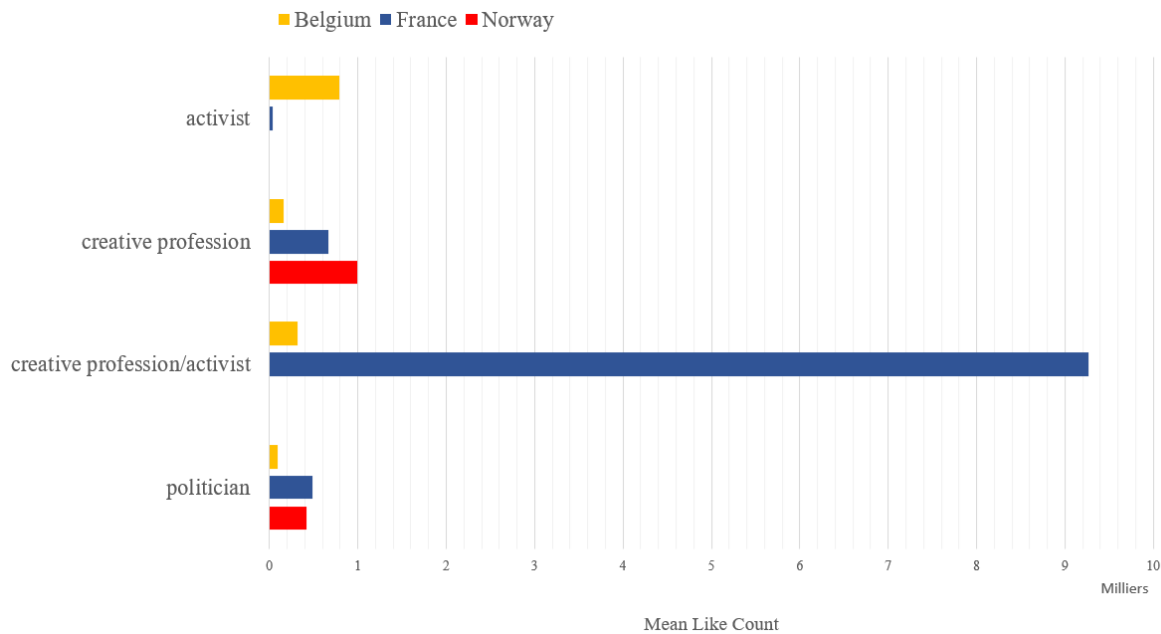


Figure 21 Average number of likes per post regarding different groups of environmental OLs

In Figure 22, we provide the mean number of comments per post calculated from the obtained metadata for each post. These numbers differ drastically according to the type of account and country in our data. For example, the highest average number of comments to one post ($N=8,2$) is observed in the posts of the French *Creative profession/activist* group. The second most frequently commented posts in our corpus are the posts by *Creative profession* group of environmental OLs in France and Norway. Interestingly, the highest number of collected posts is attributed to Belgian *Politicians* (cf. Table 10). However, the posts by French *Politicians* seem to be commented on more frequently in our corpus. The posts by *Politicians* in Belgium are the least commented category of posts within the *Corpus21-22*.

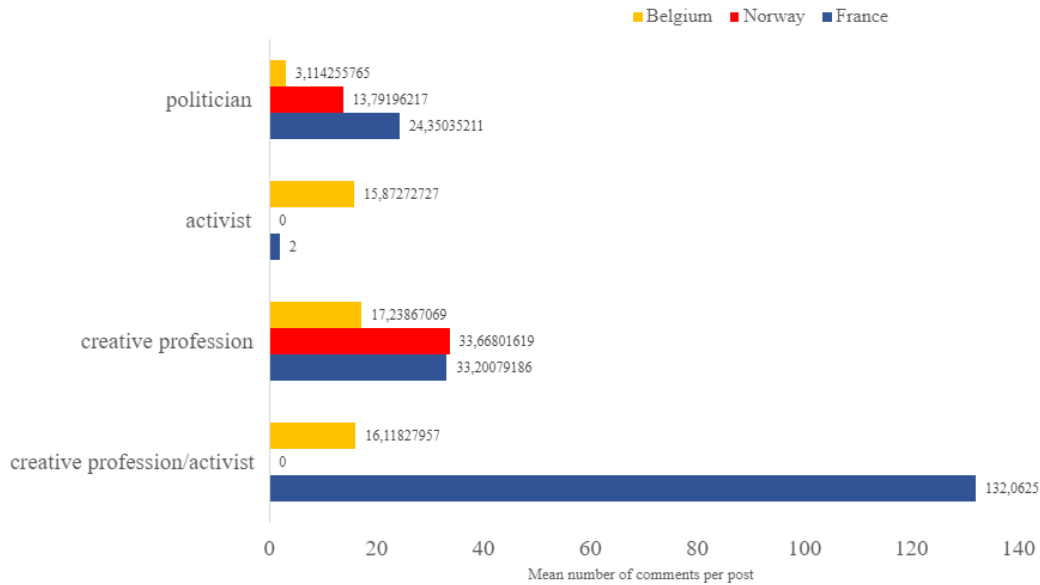


Figure 22 Mean number of comments per post by different groups of environmental OLs

In addition to the engagement metrics per post regarding different types of enunciators, we also observed the engagement metrics concerning the type of content posted by environmental OLs. The posts that included at least one video were considered video content, and the posts that included images only were named as images. By calculating the mean number of likes and comments per post, we found that video content is more liked and commented in France and Belgium in comparison to image content. The detailed numbers are illustrated in Figure 23. This high average number of posts with video content is mainly related to the videos by the group *Creative professions/Activists*.

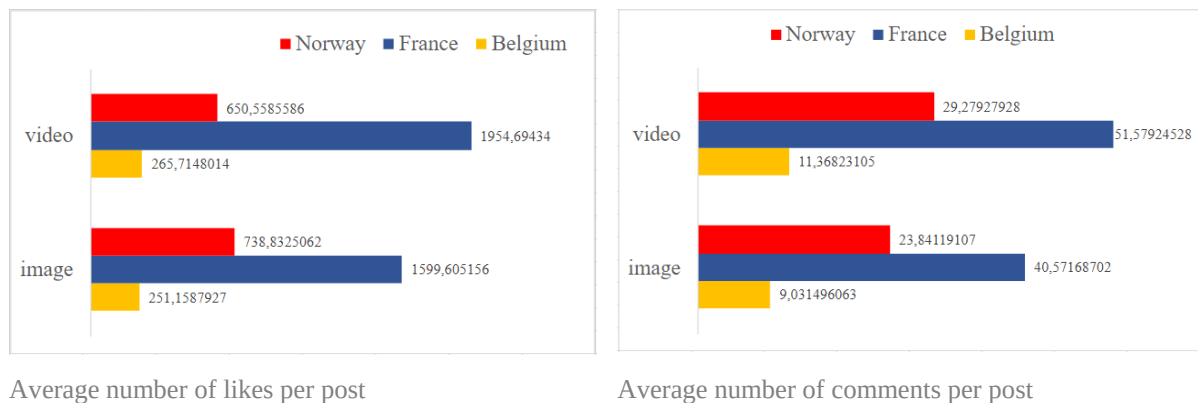


Figure 23 Average numbers of likes and comments per post to as reactions to the posts by environmental OLs per type of post and country

In addition to popularity metrics, we also observed the distribution of posts by environmental OLs in the three countries according to the day they were posted on Instagram. In Belgium (Figure 24), the number of posts by environmental OLs per day within the *Corpus21-22* tended to decrease from May 2021 to the end of March 2022. The peak date of the highest number of posts in Belgium was 4 May 2021. This day, the environmental OLs posted about COVID-19, campaign #BalanceTonSport, perspectives of COP26, and promotion of a theatre play about zero waste by one OL, which was advertised in a set of eight posts revealing the poster of the event. The posts around 20 July 2021 discussed the Belgian National holiday. On 10 October 2021, there was a climate strike organized in Brussels, and some posts advertising the strike preceded this date, while others following this date provided reports about the action. On 8 March 2022, the number of posts slightly increased. These posts were predominantly dedicated to International Women's Rights Day.

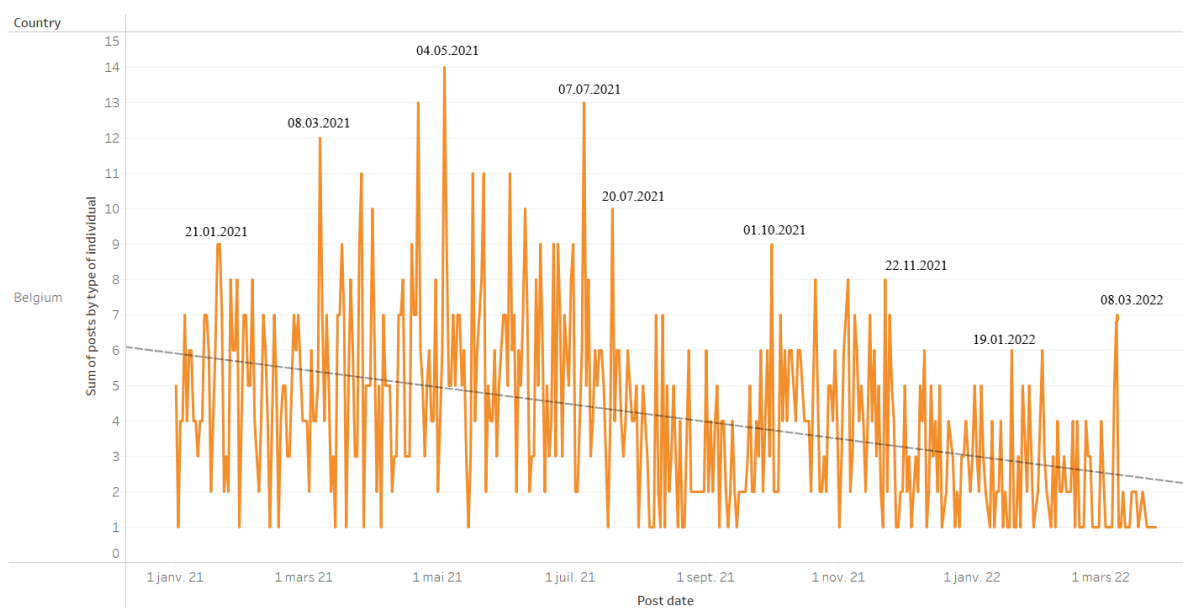


Figure 24 Distribution of posts by environmental OLs in Belgium according to date (*Corpus21-22*)

Unlike Belgium, we observed that the number of daily posts by environmental OLs in France (Figure 25) increased during 2021–2022. This is directly related to the beginning of the presidential campaign in France. For example, in September 2021, the Ecology party organized primaries and discussed their candidate program in Instagram posts afterward. A particular rise of posts at the beginning of 2022 is directly related to the presidential elections in France, which happened on 10 and 24 April 2022.

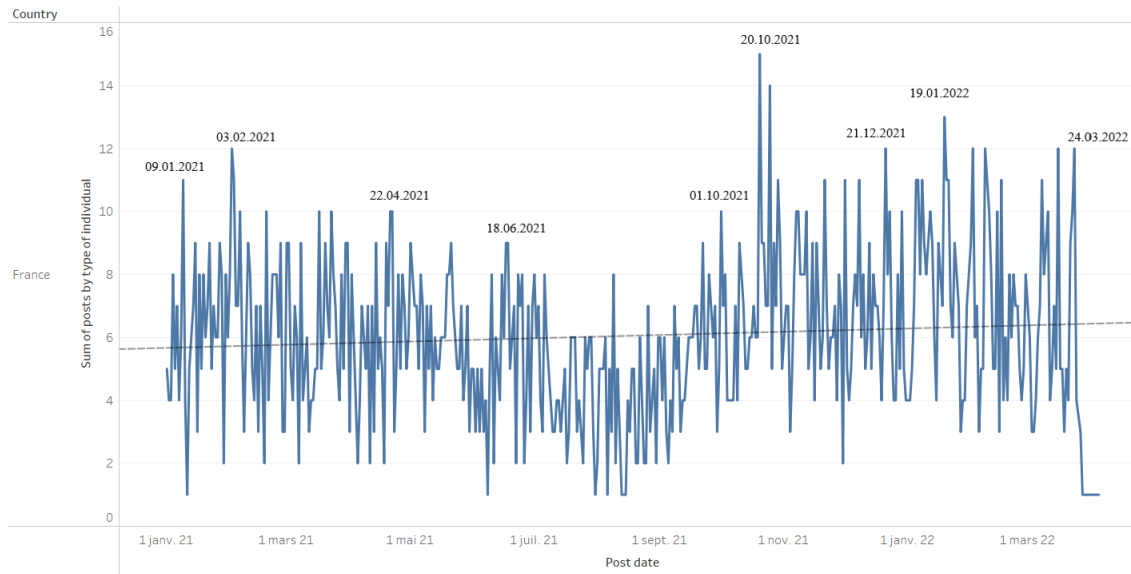


Figure 25 Distribution of posts by environmental OLOs in France according to date (Corpus21-22)

In Norway (Figure 26), the posting tendency in our corpus was rather stable, with only several peak moments. For example, the posts by the environmental OLOs around 17 May 2021 discussed holidays in relation to Constitution Day. In August–September 2021, the majority of the posts discussed the environmental claims within the parliamentary election campaigns.

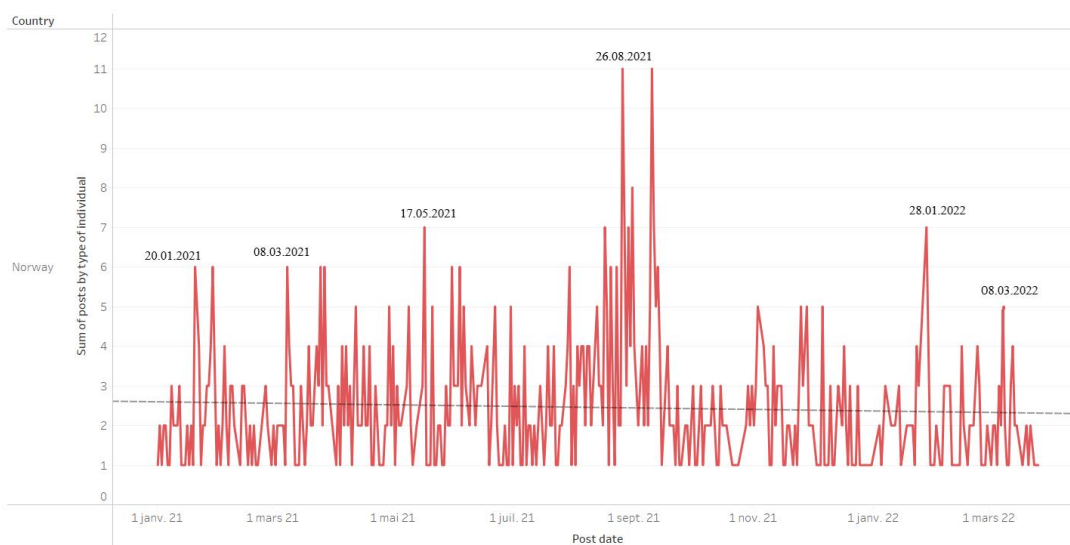


Figure 26 Distribution of posts by environmental OLOs in Norway according to date (Corpus21-22)

The environmental OLOs in the corpus are represented by different governmental and non-governmental organizations and media pages that advocate for climate in the three countries.

Several statistics about the collected data were previously introduced in part 4.2.2.2 *Collected corpus of Instagram posts*. In this part, we focus on the description of the collected visual data, popularity metrics of the accounts, and distribution of posts by date.

Generally, all organizations in our corpus data prefer to post still images and almost ignore videos (Figure 27). In Belgium, the highest number of videos was posted by the green Flemish political party Groen (N=58). In France, the accounts of WWF (N=55) and Oxfam France (N=43) posted the most significant number of videos. In Norway, the account of Greenpeace posted 40 videos during January 2021–March 2022. Since the organizations posting more videos were large environmental NGOs, we suppose that they used videos as their communication strategy since video content in Reels format is recommended more easily on Instagram and usually obtains the highest engagement rates (Cucu, 2023).

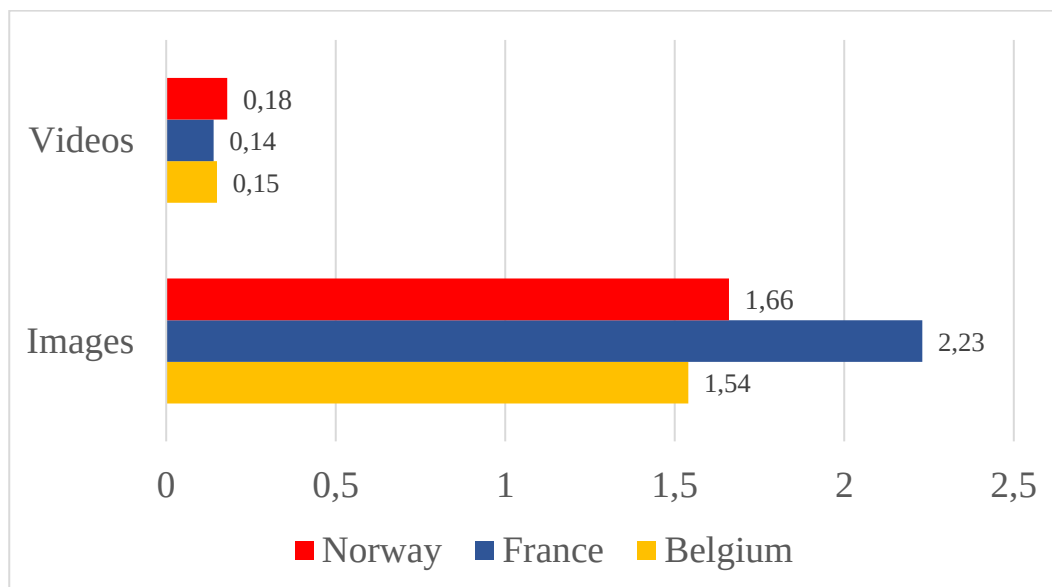


Figure 27 Mean numbers of images and videos per post, corpus of environmental OLOs

Regarding the popularity metrics, the highest average number of likes per post was the posts by the French environmental OLOs (N=1243). In Norway, the mean like count per post constitutes 289 likes. In Belgium, this number is equivalent to 243 likes. Posts in the French subcorpus were the most frequently commented, with 15,22 comments per post on average. In Belgium, the average number of comments per post is 6,07. In Norway, it is 5,99. The higher number of comments to the French posts can be explained by the higher number of followers of the collected French accounts.

Although the organizations do not post much video content, this content remains very popular among their audiences and gains in the number of likes and comments. As such, the video content posted by French organizations in the corpus is slightly more liked and commented on by the audiences. Images remain the most liked type of content in Belgium, yet the average number of likes per video content is very close to the images. The detailed average numbers of likes and comments per post regarding the posted type of content are illustrated in Figure 28. Since it is possible to post up to ten images and videos in one Instagram post, we call “video” posts in Figure 28 the posts that include at least one video.

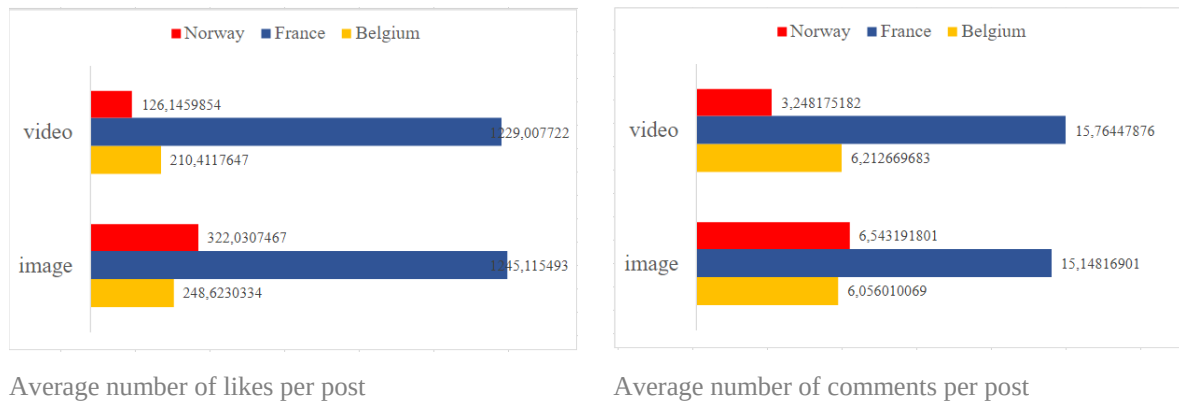


Figure 28 Average numbers of likes and comments per post to the posts by environmental OLOs per the type of post and the country

Like environmental OLs in Belgium, Belgian organizations tended to post less content at the beginning of 2022 than in 2021 (cf. Figure 29). The highest number of posts in April 2021 evoked the #PlaylistforEarth campaign by @clientearth. In September 2021, many posts discussed preparation for protesting action on 10 October 2021.

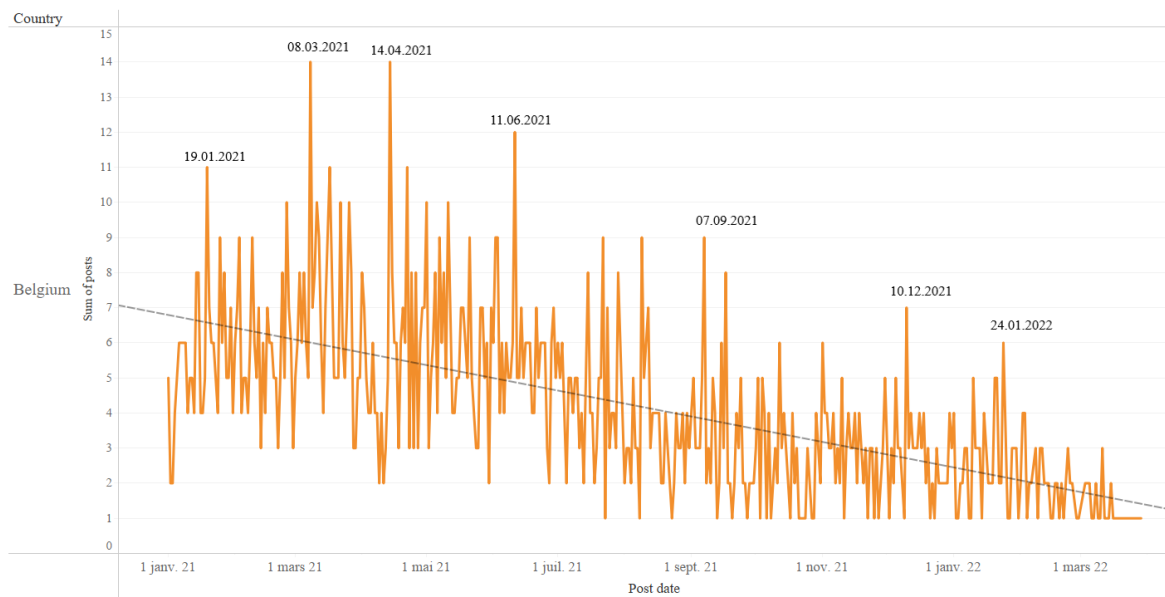


Figure 29 Distribution of posts by environmental OLOs in Belgium according to date, Corpus21-22

Contrary to environmental OLs, the number of posts by the OLOs in France decreased at the beginning of 2022. Figure 30 demonstrates the highest number of French posts in June 2021. This period covered the regional elections in France and motivated the audiences to vote for green parties.

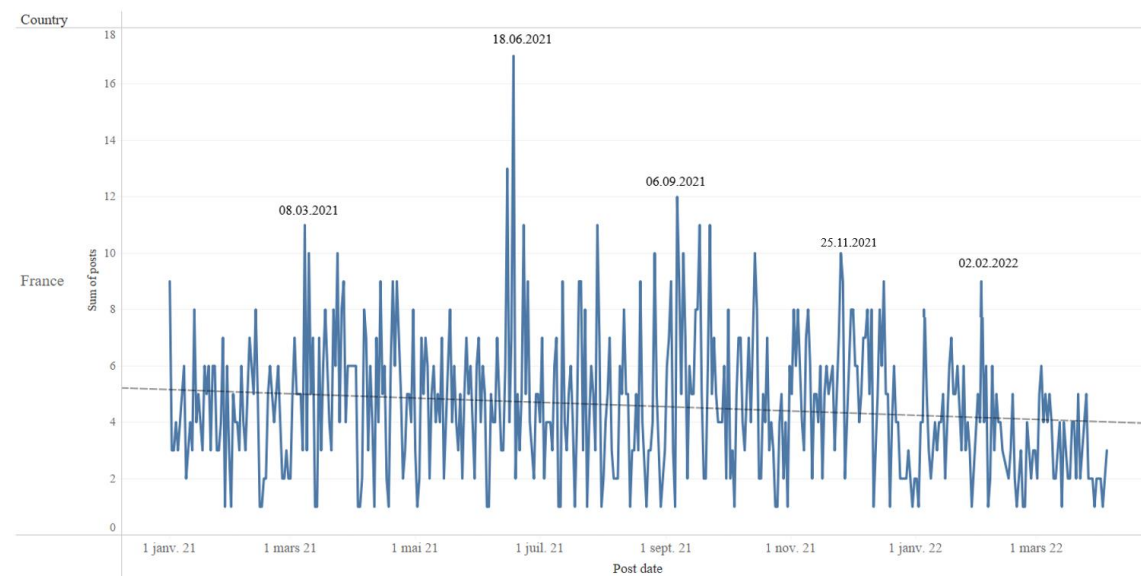


Figure 30 Distribution of posts by environmental OLOs in France according to date, Corpus21-22

In Norway, the number of posts by organizations increases in our corpus at the end of 2021 and the beginning of 2022. As in the case of environmental OLOs in Norway, the significant rise in the number of published posts by OLOs in September was related to the parliamentary elections.

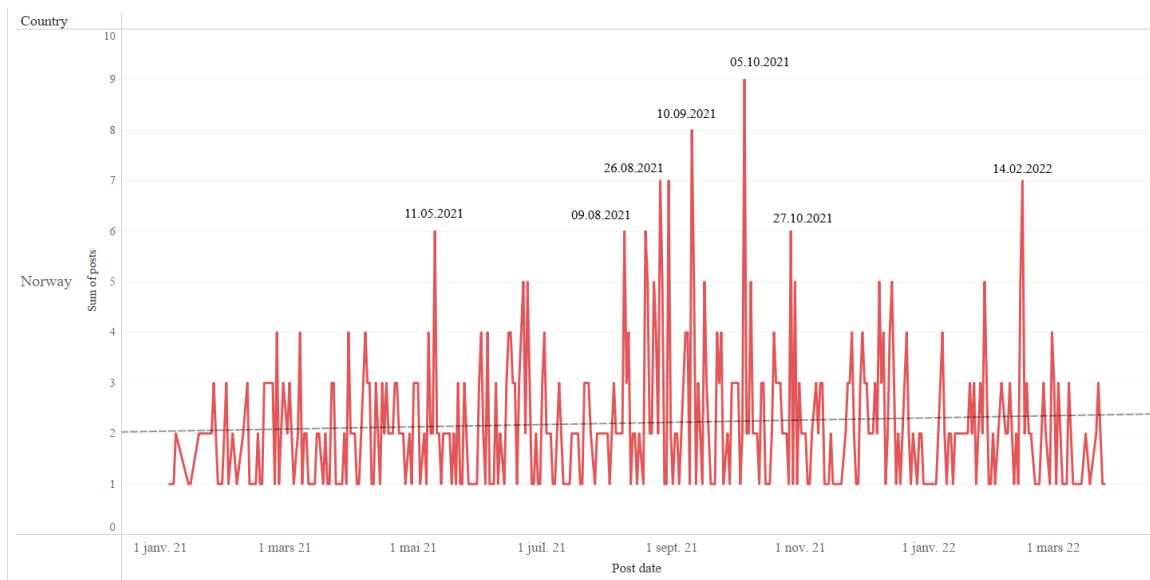


Figure 31 Distribution of posts by environmental OLOs in Norway according to date, *Corpus21-22*

In addition to the engagement metrics and temporal distribution of the posts, we observed the use of hashtags and mentions in the *Corpus21-22*. On average, the environmental OLOs in the three countries used more frequently at least one hashtag in their posts in comparison to the accounts of individuals. The individuals, in their turn, preferred to apply mentions more frequently than organizations in the three countries. It is interesting that the environmental OLOs and OLOs in France tended to apply hashtags and mentions to their posts more frequently than in other countries. Detailed statistics of each type of metadata, i.e., hashtag or mention, according to the types of enunciators in each country, are presented in Table 11.

Table 11 Numbers of hashtags and mentions in the posts by environmental OLs and OLOs in Belgium, France, and Norway, concerning the total number of posts by each category of enunciator in the Corpus21-22

Type of data	Enunciator	Country	Number of posts	Total number of posts Corpus21-22	hashtag/mention, % of total
hashtag	OL	BE	1316	1805	72,91%
hashtag	OL	FR	2233	2737	81,59%
hashtag	OL	NO	334	917	36,42%
hashtag	OLO	BE	1425	1810	78,73%
hashtag	OLO	FR	1726	2027	85,15%
hashtag	OLO	NO	468	827	56,59%
mention	OL	BE	869	1804	48,17%
mention	OL	FR	1338	2737	48,89%
mention	OL	NO	304	917	33,15%
mention	OLO	BE	680	1810	37,57%
mention	OLO	FR	875	2027	43,17%
mention	OLO	NO	237	827	28,66%

To summarize, the *Corpus21-22* represents diverse data posted by environmental OLs and OLOs in the three countries. We observed different engagement metrics of the accounts of individuals by drawing particular attention to the type of account, i.e., *Politician*, *Activist*, *Creative profession*, *Creative profession/activist*. In our corpus, individuals with the *Creative profession/Activist* group tended to post more content within our data. In addition, their audiences were highly engaged with the posted content compared to other groups of enunciators. Environmental OLOs in our corpus were represented by different organizations and social movements. In this work, we do not make a clear distinction between them due to the complex nature of different denominations of organizational structures, which are not often mentioned on the Instagram pages or websites of the selected organizations. The posts by environmental OLs and OLOs are distributed differently throughout the observed period, and the highest numbers of posts are observed in relation to particular events in each country, such as parliamentary or presidential elections. All types of enunciators – individuals and organizations – preferred to post still images, with a slight prevalence of video format posted by individuals pursuing *Creative professions*. Although both environmental OLs and OLOs posted fewer videos than images between January 2021 and March 2022, their audiences preferred the video content. In particular, the average number of likes and comments per video post was higher in France and Belgium. In the next section, we go beyond corpus data examination and discuss the results from data analyses in detail.

5.2 Reflecting on general observations of the data

In the previous section, we provided different statistics regarding the data obtained for the analysis. This part proposes a synthesis and reflection on the selected data for multimodal content analysis. In further paragraphs, we discuss the relationships between the types of content, the engagement metrics such as likes or comments, and certain types of metadata, e.g., hashtags and mentions, to the posts by different enunciators.

Our findings from Section 5.1 *Engagement metrics and metadata of the Corpus21-22* revealed that both individuals and organizations preferred to post still images in January 2021–March 2022. Among the environmental OLs, we identified four groups of individual enunciators, i.e., Activists, Politicians, Creative professions, and Creative professions/Activists. Although all these groups of enunciators represent environmental OLs in our data, some groups appear to be more or less close to the definitions of influencers or greenfluencers provided in Chapter 2.2 *Opinion-leading and influential individuals in environmental communication*. For example, individuals pursuing creative professions tended to use Instagram to monetize their accounts by providing more authentic content for their audiences. In this case, the accounts of such individuals in our corpus are closely connected to the definitions of *influencer* provided by Hund (2023) or *greenfluencers* by Boerman (2022).

Furthermore, people pursuing Creative professions tended to post more sponsored content or content in collaboration with different sustainable brands. In this context, it is not surprising that the individuals maintaining creative professions tended to post more visual content than other categories of individuals. Besides, the posts by the environmental OLs pursuing creative professions, such as greenfluencers, artists, writers, or business owners, obtained the highest numbers of likes from the audiences. This elevated average number of likes and comments per post can be directly related to the professional nature of the communication of such influencers. They might have more experience with digital content creation, marketing, and communication strategies than other categories of environmental OLs (van Driel & Dumitrica, 2021), and, therefore, they might attract more audience attention. In addition to this, people pursuing creative professions tended to post more content about personal experiences, views, or common habits, which created emotional appeals with their audiences that can also positively influence the engagement rates of the account (Aramendia-Muneta et al., 2021; Rietveld et al., 2020).

Regarding other types of environmental OLs, it is interesting that the corpus of the French environmental OLs comprised a smaller number of activists. First and foremost, it can be directly related to a manual data selection method. During this process, some of the activists' accounts were not considered since they did not possess the necessary number of followers or did not fully correspond to our criteria of environmental OLs provided in Section 4.2.1 *Selecting accounts of climate change opinion leaders and opinion-leading organizations*. In addition to this, the lower number of activists present in the French subcorpus can be related to the organization of environmental activism in France. In particular, environmental activism is represented by multiple national and local groups that have their own social media pages yet without designating particular leaders (Samofalova et al., forthcoming). In addition to this, the groups of environmental activists in France avoid the identification of particular leaders within the group (Derolez et al., 2019), which can also lead to difficulty in the identification of climate activists in France since the leaders are sometimes neither self-designated nor selected by other people.

Another interesting point concerning different groups of environmental OLs is that the posts by politicians representing environmental OLs in France are more frequently commented on than the posts by Belgian or Norwegian politicians in our corpora. It is particularly interesting because the number of accounts and posts collected by Belgian politicians is higher than the amount of data collected by the French politicians in our data. On the one hand, the higher number of audience engagement with the posts by the French politicians representing environmental OLs can be explained by a higher average number of their followers (approximately 10k on average) in comparison to Belgian (approximately 2k) or Norwegian politicians (around 5,9k) in our data. On the other hand, this high engagement with the posts of French political leaders involved in CC-related issues can be related to the regional elections and presidential elections campaigns in France in 2021–2022. Indeed, based on our data, French politicians motivated their audiences to share their views on different sustainability policies by posing questions at the end of a post, possibly enhancing their audience's engagement.

If we compare the engagement rates of environmental OLs to environmental OLOs in our data, the posts by individuals are, on average, more liked and commented by the audiences. First, this higher engagement can be related to a higher number of posts collected from the accounts of OLs in our data, which represents methodological bias. Second, the OLs tended to

share their posts and vary the themes of the posts more frequently, which could also influence users' engagement (Rietveld et al., 2020).

Although a high number of followers can negatively influence user engagement on Instagram (Tafesse & Wood, 2021), our data did not fully confirm this. In Belgium and Norway, the average number of followers of environmental OLs is higher than the average number of followers of OLOs, yet the accounts of individuals demonstrated higher engagement rates than the accounts of organizations. The French data, on the contrary, demonstrated similar results as in the study by Tafesse and Wood (2021): the average number of followers to the accounts of organizations was higher than to the accounts of individuals, and the engagement rate of the accounts by OLOs was lower in comparison to the accounts of OLs. This can be explained by marketing research demonstrating that the accounts of micro-influencers having 1–100k followers obtain the highest engagement rates (R. Conde & Casais, 2023; Tafesse & Wood, 2021)

Considering the types of visuals, video content posted by both environmental OLs and OLOs is generally more commented on by their audiences, yet the average number of comments per post written by individuals is almost 50% higher than the average number of comments to a post by organizations. Because the audiences prefer to comment on the video content and the individuals tended to post almost twice as many videos as organizations, this may enable a better explanation of higher engagement rates of the accounts of environmental OLs.

The situation with likes to the posts is unstable in our corpus. Images by environmental OLs in Norway are liked more than the videos by the same enunciators. However, the videos are more liked by the audiences of environmental OLs in Belgium and France. Indeed, some studies demonstrated that video content on Instagram can achieve a higher number of likes than still images (Cuevas-Molano et al., 2021) since people prefer video content on Instagram due to its better authenticity in comparison to still images (Maares et al., 2021). Regarding the organizations, their audiences typically preferred still images that gained in number of likes compared to video content in 2021–2022. Besides, the OLOs tended to post more hashtags to the posts including still images, in comparison to the OLs, which could also increase the number of likes to the post, as in the study by Cuevas-Molano et al. (2021).

Regarding the temporal distribution of the posts, the peak numbers of posts in each country were frequently related to national or international events and conditions. For example, a high number of posts by Belgian OLs and OLOs in July 2021 is directly related to the floods

in the country that appeared in that period. In August 2021, the IPCC report was released, which also increased the number of posts around this issue in the three countries. Nevertheless, the posts in *Corpus21-22* did not cover the IPCC report released in February 2022. In September 2021, many posts in the French and Belgian data were posted to promote the civil protesting actions organized by the climate movements in these countries on 10 October 2021. In France, the peaks in the number of posts are also related to the regional and presidential elections in June 2021 and April 2022, respectively. In Norway, the number of posts increased in August–September 2021 prior to the parliamentary elections on 13 September 2021. Besides local events, we observed a cyclical pattern around the COP26 summit. In the three countries, the number of posts increased from October to November 2021, which can be related to the number of posts covering the COP26 meetings between 31 October and 12 November 2021. However, this rise in the number of posts around the COP26 meetings is not significant compared to other dates. In addition, in the three countries, the number of posts slightly increased around 8 March 2021 and 8 March 2022: this fact can be related to a high number of posts considering climate and social justice concerning Women’s Rights Day.

To recapitulate, in this part, we discussed the relationship between different engagement metrics, such as the numbers of likes or comments to the posts by the environmental OLs and OLOs in *Corpus21-22*. In some cases, the type of visual content (e.g., videos) and the use of hashtags could positively influence engagement rates. However, this claim demands further investigation by regression models and qualitative analysis to provide a better picture of the relationship between the numbers of likes, comments, and the added hashtags and mentions to the posts. Finally, the peaks in the number of posts by all enunciators in our data are directly related to specific national or international events or conditions, as in the study on visuals from Twitter data by Mooseder, Brantner, and Pfeffer (2023) or Wang et al. (2018).

Chapter 5: Key findings

- Environmental OLs and OLOs tended to post more still images than videos.
- Compared to OLOs, the OLs posted videos more frequently.
- The environmental OLs pursuing Creative professions tended to post more content about personal experiences.

- The posts by Politicians in France were more frequently commented on than the posts by politicians in Belgium and Norway.
- The posts by Politicians in Belgium were the least frequently commented on.
- Posts by environmental OLs are generally more liked and commented on than posts by environmental OLOs.
- The OLOs tended to incorporate hashtags in their posts more frequently than the environmental OLs.
- The OLs tended to mention other accounts in their posts more frequently compared to the OLOs.
- The peak numbers of posts in each country were mainly related to national and international events, such as local, governmental, or presidential elections and the COP meetings.

Chapter 6 Multimodal content analysis of Instagram posts: Corpus21-22_FET

This chapter discusses the results from multimodal content analysis of Instagram posts by environmental OLs and OLOs between January 2021 and March 2022 regarding the food, energy, and transport sectors. These posts were automatically pre-selected with the help of an automated content analysis that we effectuated with the help of thematic labeling in MaxQDA. The detailed procedure was discussed in Section 4.3.1 *Automated content analysis*. In this part, we focus on the outcomes from a somewhat manual and quantitative approach to the posts from *Corpus21-22_FET*. We start from the results considering Belgian data, then we discuss the French and Norwegian subcorpora. We conclude this chapter with a discussion of the results.

6.1 Belgium

In this section, we introduce the results from multimodal content analysis of the posts in *Corpus21-22_FET*. First, we demonstrate the results from the analysis of the posts by OLs in Belgium (N=327). Second, we assess the results from the analysis of the posts by OLOs in Belgium (N=358). Each part is structured according to the themes of the Codebook questions in the following order: CC themes, climate actions and actors, obstacles, and values.

6.1.1 Instagram communication by environmental OLs about the sustainability transition in the food, energy, and transport sectors in Belgium

6.1.1.1 CC themes

In 84% of the analyzed posts regarding food, energy, or transport spheres, Belgian environmental OLs either directly¹⁶ (N=224) or indirectly¹⁷ (N=52) discuss CC and environment-related spheres. They mentioned food-related themes in 107 posts (39% of posts considering CC issues), energy-related themes in 97 posts (35% of posts considering CC issues), and transport-related themes in 43 posts (15% of posts considering CC issues). In 58

¹⁶ When CC or environment-related topics were explicitly mentioned in the posts

¹⁷ When CC or environment-related topics were implicitly suggested in the posts

manger, légume, zerodechet, 🌱 emoji, animal, local. Energy-related words include *energie, énergie, energy, fuel, and fossil.* The transport sector remains underrepresented. Figure 32 highlights the words that contextualize Belgian data not only within the country (e.g., *Wallonie, Belgium, Belgique, Brussels, Bruxelles*) but also as a center of the European Union (e.g., *européen, Europe*).

6.1.1.2 Climate actions and actors

In the posts about CC and sustainability transition in the food, energy, and transport sectors, we observed different individual and group actions that are followed by the enunciator or suggested to others to follow. These actions appeared in the posts both in visual and verbal modes, with a high prevalence of appearances in the captions to the posts. In the majority of the posts, the different actions appeared in combination with each other. In some cases, posts included a combination of actions in different sectors.

When talking about food, environmental OLs in Belgium suggested, on an **individual level**, reducing food waste, consuming organic products, following a vegetarian regime, organizing a home garden, consuming local food, reducing meat consumption, consuming seasonal food, composting, buying in bulk, organizing the kitchen in an eco-responsible manner, and eating better. **On the group level**, the OLs mentioned such actions as financing agriculture, no pesticide use by agriculture workers, reducing or banning plastic packaging for food items, withdrawing the Common Agricultural Policy (CAP), regulating agricultural policies, developing agroecology, and vegetarian catering. The numbers of occurrences of each action in the posts are shown in Table 12.

In sum, the group actions included sustainability transition in the agriculture sector, representing the most frequent group of actions. They encompassed financing agriculture, preventing pesticide use, withdrawing the CAP, regulating agricultural policies, and developing agroecology. On the individual level, the most frequent cluster included the changes in food diets such as consuming local, bio, and seasonal food products, reducing meat consumption, and following vegetarian food diets.

Table 12 Pro-environmental actions in the food sphere by environmental OLs in Belgium

Action	Number of occurrences	% of analyzed posts about the food sector, OLs
Individual action		
no food waste	16	14,95
organic products consumption	13	12,15
following a vegetarian diet	9	8,41%
organizing a home garden	8	7,48%
consumption of local food	7	6,54%
reducing meat consumption	6	5,61%
consuming seasonal food	4	3,74%
composting	3	2,80%
buying in bulk	2	1,87%
organizing the kitchen in an eco-responsible manner	2	1,87%
eating better	1	0,93%
Group action		
financing agriculture	13	12,15
no pesticide use by agriculture workers	10	9,35%
reducing or banning plastic packaging for food items	8	7,48%
withdrawing the CAP	6	5,61%
regulating agricultural policies	5	4,67%
developing agroecology	2	1,87%
vegetarian catering	1	0,93%
Total posts about the food sector	107	

In the energy sector, pro-environmental actions were represented majorly by different collective or group actions, which should be governed at the level of government or companies. These actions included the development of renewable energies, no investment in fossil fuels, optimized construction, providing financial support to the citizens against energy prices rise, no use of nuclear energy, no use of coal mines, improving energy labels for electronic devices, fostering energy transition, development of batteries recycling, use of safe nuclear energy, and sustainable education about the renewable energies. As we may see from the list of group actions, most of them were directed at developing and increasing the use of renewable energies. The second and third most frequent actions considered reducing the use of fossil fuels. These actions appeared in the same post, more frequently in the verbal mode. In these posts, fossil fuels were opposed to renewable energies. On the individual level, environmental OLs in Belgium proposed to reduce energy use. In Table 13, we provide the numbers of occurrences of each action in the analyzed posts about the sustainability transition in the energy sector.

Table 13 Pro-environmental actions in the energy sphere by environmental OLs in Belgium

Action	Number of occurrences	% of analyzed posts about the energy sector, OLs
Individual action		
Reduce energy use	4	4,12%
Group action		
Develop renewable energies	46	47,42%
Stop investing in fossil fuels	15	15,46%
No use of fossil fuels	6	6,19%
Optimize building construction	5	5,15%
Support citizens against energy price rise	5	5,15%
No use of nuclear energy	3	3,09%
No coal mines	2	2,06%
Improve energy labels for electronic devices	2	2,06%
Foster energy transition	2	2,06%
Develop batteries recycling	1	1,03%
Use of safe nuclear energy	1	1,03%
Sustainability education about renewable energies	1	1,03%
Total posts about the energy sector	97	

Compared to the food and energy sectors, fewer environmental actions were proposed for the sustainability transition in the transport sector. They included more frequent use of bikes, reducing individual transportation by car and plane, and using electric vehicles on the individual level. On the group level, the proposed actions are the development of train infrastructure, financing public transport, decarbonizing public transport, developing and improving cycling infrastructures, and ceasing fossil fuel transport in the cities. The detailed numbers for each action are demonstrated in Table 14.

Table 14 Pro-environmental actions in the transport sphere by environmental OLs in Belgium

Action	Number of occurrences	% of analyzed posts about the transport sector, OLs
Individual action		
Use of bikes	13	30,23%
Use of electric vehicles	4	9,30%
Reducing individual car use	3	6,98%
Reducing individual travel by plane	3	6,98%
Group action		
Development of train infrastructure	6	13,95%
Financing public transport	3	6,98%
Decarbonization of public transport	3	6,98%
Development and improvement of cycling infrastructures	2	4,65%
No fossil fuel transport in cities	1	2,33%
Total posts about the transport sector	43	

In the analyzed posts by environmental OLs in Belgium, we identified different actors responsible for pro-environmental actions, such as people or organizations that should act for the climate. These actors are represented by the government, “you” – a second-person narrator, all people or “us”/“we,” “myself,” companies, the EU, activists, and politicians (Figure 33). Figure 33 represents the percentage of occurrences of each actor in the analyzed posts regarding the food, energy, and transport sectors. In most of the data, several actors that need to contribute to CC mitigation were mentioned. In the analyzed corpus of posts by environmental OLs in Belgium, particular attention was attributed to the government, which should be supported by individuals, such as “you” – people reading the posts, “everybody,” and “me/myself” in particular.

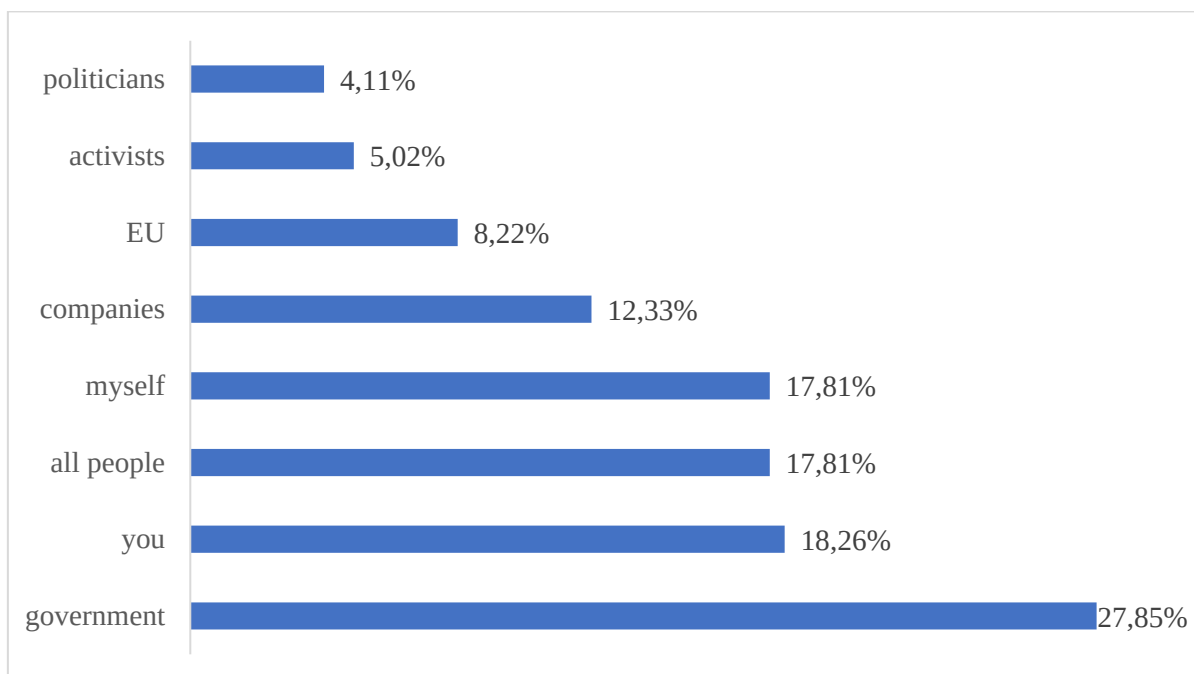


Figure 33 Actors responsible for CC mitigation mentioned in the posts by environmental OLs in Belgium, % of the total number of posts regarding food, energy, and transport themes (N=219)

In the majority of the posts by Belgian politicians, pro-environmental action is pictured in a positive way, addressing the solutions to CC mitigation and reporting the results of their work regarding the sustainability transition. For example, a post by Celine Tellier, minister of the Environment in Wallonia, illustrates the support of agriculture workers and their adaptation to the climate crisis by the Wallonia government (Figure 34). In the caption to the posts, the

minister highlights the investments attributed to research in the agriculture sector, in particular, the production of local food:

“[...] Nous investissons dans la recherche pour permettre aux agriculteurs de diversifier leur production en produisant localement de nouvelles cultures [...] Bref, nous travaillons du champ à l’assiette pour atteindre un objectif ambitieux : fournir des repas locaux, durables et sains à la moitié des cantines en Wallonie d’ici 2030. [...]”

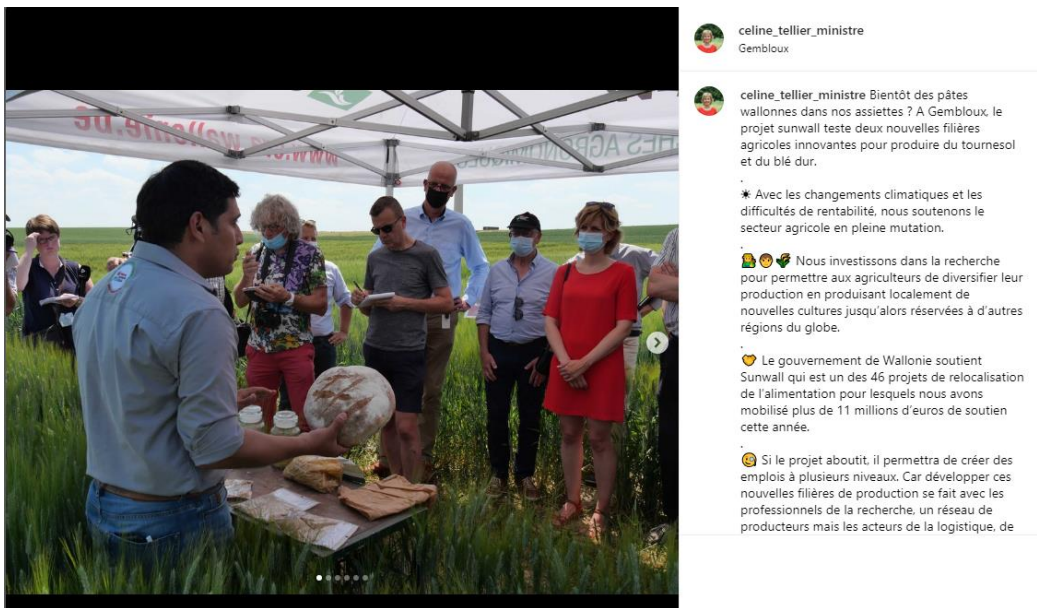


Figure 34 Post by @celine_tellier_ministre, 16.06.2021

6.1.1.3 Obstacles

In the majority of the posts, the environmental OLs did not evoke particular obstacles or barriers to CC mitigation. In several posts, the most frequent obstacle was the *wrong political action* (N=20/276 posts considering environment-related themes in the food, energy, and transport spheres). By wrong political action, we understand the signing of controversial documents, the development of plans that contradict sustainable development plans, and the lack of contribution to the development of sustainable policies by the government or politicians. Another obstacle was *corporate misbehavior* (N=7/276 posts), which can be described as the unwillingness of the companies to contribute to CC mitigation and pursue non-environmentally-friendly activities.

On an individual level, several obstacles were identified, including *feelings of anxiety, guilt, or frustration* (N=5/276), *insufficient financial resources* (N=3/276), *lack of time* (N=3), *difficulty in doing the action* (N=2/276), *considering the action as not consistent* (3/276), *controversial information about ecology* (N=1). The feelings of anxiety, guilt, and frustration reflected individuals' feelings towards climate action in general. The barrier related to the *lack of financial resources* was addressed by buying bio and local food products and installing solar panels on individual houses. *Lack of time* to contribute to CC mitigation was mentioned in the actions in the three spheres: food, energy, and transport. *Difficulty in the action* considered the adaptation of the food menus to vegetarian or vegan lifestyles. *Climate action was considered inconsistent* in several posts that addressed the government's measures in regulating energy policies, specifically financing fossil fuels and reducing financial support for individual installation of solar panels in Flanders. Controversial information about fossil fuels and renewable energies appearing in media sources was also mentioned as an obstacle in one post. These above-discussed obstacles were either explicitly or implicitly introduced in the verbal mode, either in the caption to the post or the text from the image. For example, one person writes:

“[...] Car oui **l'éco-anxiété je l'ai traversé et je la traverse encore**. C'est la petite voix dans la tête qui nous ramène les infos négatives et dépressives et **qu'il faut apprendre à combattre**. Et continuer à rêver, à se projeter, planifier me permet de rester positive sur le monde et ma vie [...]"

In this example, eco-anxiety is introduced at the beginning of the phrase, where the author claimed that she had been anxious about the environment and still sometimes had the same feeling. While this feeling can have negative consequences, the author emphasized the necessity to combat it.

The actors contributing to these obstacles, in other words, the actors criticized for their irresponsible behavior regarding sustainability transition, were represented by different individual and collective actors. In most posts – 177 out of 276 posts considering CC and environment-related topics regarding the food, energy, and transport sectors – no criticized actor was observed. In the rest of the posts, the criticized figures were the EU (N=16), different companies (N=9), as *Total*, *Shell* or banks, government (N=8), politicians (N=7), and all people (N=1).

6.1.1.4 Values

Environmental values can be a very ambivalent category of analysis demanding the knowledge of specific contexts and a complex understanding of the discourse. The most frequently present environmental values were biospheric and egoistic. The environmental OLs claimed environmental protection, preventing pollution, being helpful to other people, social justice, and the health of all people. Among 219 posts regarding food, energy, and transport themes by environmental OLs in Belgium, we identified 100 posts (45,66%) where biospheric values were present. In 87 posts (39,73%), we observed altruistic values. Egoistic values were present in 88 (40,18%) of analyzed posts. Hedonic values appeared in 47 (21,46%) Instagram posts. Complete statistics regarding the values that appeared in the posts by environmental OLs are explained in Table 15.

Table 15 Observed values in the posts by environmental OLs in Belgium, % of the total number of posts regarding food, energy, and transport themes (N=219)

Value cluster	Value item	Number of posts in general (in %)		Number of posts concerning obstacles (in %)	
Biospheric		100	45,66%	-	-
	Unity with nature	1	0,46%	-	-
	Respecting the Earth	2	0,91%	-	-
	Protecting the environment	51	23,29%	-	-
	Preventing pollution	49	22,37%	-	-
Altruistic		87	39,73%	-	-
	Health of all people	21	9,59%	-	-
	Helpful to others	31	14,16%	-	-
	Social justice	30	13,70%	-	-
Egoistic		88	40,18%	32	14,61%
	Successful	11	5,02%	-	-
	Social recognition	1	0,46%	-	-
	Ambitious	13	5,94%	1	0,46%
	Wealth	47	21,46%	12	5,48%
	Influential	5	2,28%	1	0,46%
	Authority	20	9,13%	10	4,57%
	Social power	9	4,11%	9	4,11%
Hedonic		47	21,46%	9	4,11%
	Inner harmony	6	2,74%	5	2,28%
	Satisfaction of accomplishment	12	5,48%	-	-
	Comfort	12	5,48%	3	1,37%
	Self-indulgent	2	0,91%	0	-
	Enjoying life	18	8,22%	1	0,46%
	Pleasure	1	0,46%	-	-

In our data, different varieties of combinations of environmental values were observed. Figure 35 demonstrates the co-appearing of different value clusters and their items in the same post. It shows how biospheric, altruistic, and egoistic value clusters and their items (preventing pollution, helping others, protecting the environment, health of all people, social justice, and wealth) are close to each other in the analyzed data. Indeed, these values were more frequently expressed as an ensemble within one post. Wealth here had a threefold meaning. First, it meant the possibility of saving some money while contributing to climate action. Second, it signified the lack of money necessary to contribute to climate action. Third, wealth referred to the necessity of suitable investments by governments, which could be beneficial for the environment and citizens. The links with other value items are also present in Figure 35, illustrating that different egoistic and hedonic value items also co-occurred in the same posts, such as authority and preventing pollution or comfort and wealth.

To recapitulate, the environmental OLOs in Belgium posted predominantly about the sustainability transition in the food and energy sectors in 2021–2022. They identified the government, themselves, and other individuals as the main responsible actors for CC mitigation. Critics and obstacles were not largely present in the posts. The most frequent obstacles mentioned were wrong political action and corporate misbehavior. The biospheric, egoistic, and altruistic values were primarily present in the analyzed posts. More frequently, we observed a combination of values intertwined in one post. For example, the biospheric value item of caring for nature was frequently combined with the altruistic value item of caring for other people. The values concerning obstacles are mainly represented by egoistic and hedonic value clusters and their items, such as wealth or authority.

6.1.2 Instagram communication by environmental OLOs about the sustainability transition in the food, energy, and transport sectors in Belgium

6.1.2.1 CC themes

Belgian environmental OLOs discussed environmental topics directly¹⁸ (N=217) or indirectly¹⁹ (N=79) in 83% of the analyzed posts from *Corpus21-22_FET*. They addressed energy-related

¹⁸ When CC or environment-related topics were explicitly mentioned in the posts

¹⁹ When CC or environment-related topics were implicitly suggested in the posts

6.1.2.2 Climate actions and actors

In discussions concerning CC and the shift toward sustainability in the food, energy, and transport sectors, we have observed various individual and collective actions advocated or suggested by the authors. These actions were conveyed both visually and verbally in the posts, with captions being a prominent mode of communication about the action. Typically, posts featured a combination of different actions across various sectors.

In the food sector, environmental OLOs advocated for reducing carbon emissions on both individual and group levels. We observed 117 occurrences of different actions in this sector. On the **individual level**, the actions in the food sector included reducing food waste, opting for local, seasonal, and organic products, cultivating home gardens, adopting a vegetarian diet, cutting down on meat consumption, and composting. On the **group level**, OLOs propose actions like supporting or investing in agriculture, avoiding pesticide use, promoting agroecology, avoiding overfishing, reforming or abolishing the CAP, and GMO regulation. In sum, individual and group actions are quite equally distributed in this data. The frequency of each action mentioned in the posts is detailed in Table 16.

Table 16 Pro-environmental actions in the food sphere by environmental OLOs in Belgium

Action	Number of occurrences	% of analyzed posts about the food sector, OLOs
Individual action		
no food waste	11	3,72%
consumption of local food	9	3,04%
consuming seasonal food	9	3,04%
organic products consumption	7	2,36%
organizing a home garden	6	2,03%
following vegetarian diets	6	2,03%
consuming sustainable food products	5	1,69%
reducing meat consumption	2	0,68%
composting	2	0,68%
Group action		
supporting agriculture	30	10,14%
no pesticides' use by agriculture workers	12	4,05%
developing agroecology	6	2,03%
stop overfishing	5	1,69%
withdrawing the CAP	4	1,35%
GMO regulation	3	1,01%
Total posts about the food sector	296	

The energy sector was the most frequent theme in the analyzed posts by environmental OLOs in Belgium in our corpus of posts in 2021–2022. In this sector, pro-environmental initiatives primarily entailed collective or group efforts, necessitating governance at governmental or corporate levels. These initiatives encompassed abstention from fossil, nuclear, and coal energy sources, the development of renewable energies, divestment from fossil fuels, leaving the Energy Charter Treaty²⁰, and suggesting new energy storage solutions. A notable trend in the listed group actions emphasized abstention from fossil fuels and developing renewable energies. These actions were often articulated verbally within the same post, juxtaposing fossil fuels with renewable energies. On the individual level, organizations suggested reducing personal energy consumption, which could be done by improving insulation, switching to energy-efficient appliances, or utilizing energy-saving modes of electronic devices. Table 17 outlines the frequency of each action discussed in the analyzed posts about sustainability transitions in the energy sector.

Table 17 Pro-environmental actions in the energy sphere by environmental OLOs in Belgium

Action	Number of occurrences	% of analyzed posts about the energy sector, OLOs
Individual action		
Reduce energy use	14	11,86%
No use of fossil fuels	60	50,85%
Development of renewable energies	35	29,66%
Stop investing in fossil fuels	13	11,02%
No use of nuclear energy	11	9,32%
Leave Energy Charter Treaty	2	1,69%
Energy storage solutions	1	0,85%
Total posts about the energy sector	118	

In comparison to the food and energy sectors, fewer environmental actions are proposed for the sustainability transition in the transport sector (68 occurrences in the corpus). On the individual level, they encompass more frequent use of trains and bikes and a reduction of individual

²⁰ Le Traité sur la Charte de l'énergie – international agreement on cooperation in the energy sector, specifically in fossil fuel industry

transportation by airplane. On a collective level, the proposed measures include the development of public transport and constructing or improving cycling and walking paths. The detailed numbers for each action are demonstrated in Table 18.

Table 18 Pro-environmental actions in the transport sphere by environmental OLOs in Belgium

Action	Number of occurrences	% of analyzed posts about the transport sector, OLOs
Individual action		
Use of trains	22	32,35%
Use of bikes	19	27,94%
Reducing individual travel by plane	6	8,82%
Group action		
Development of public transport	38	55,88%
Development and improvement of cycling infrastructures	2	2,94%
Development of walking infrastructures	1	1,47%
Total posts about the transport sector	68	

In the examined posts authored by environmental OLOs in Belgium, various actors responsible for pro-environmental actions were identified, including governmental bodies, second-person narrators (“you”), citizens or all people (“we”/“us” were included in this category), activists, the European Union (EU), corporations, politicians, farmers, and an indefinite pronoun “on” (Figure 37).

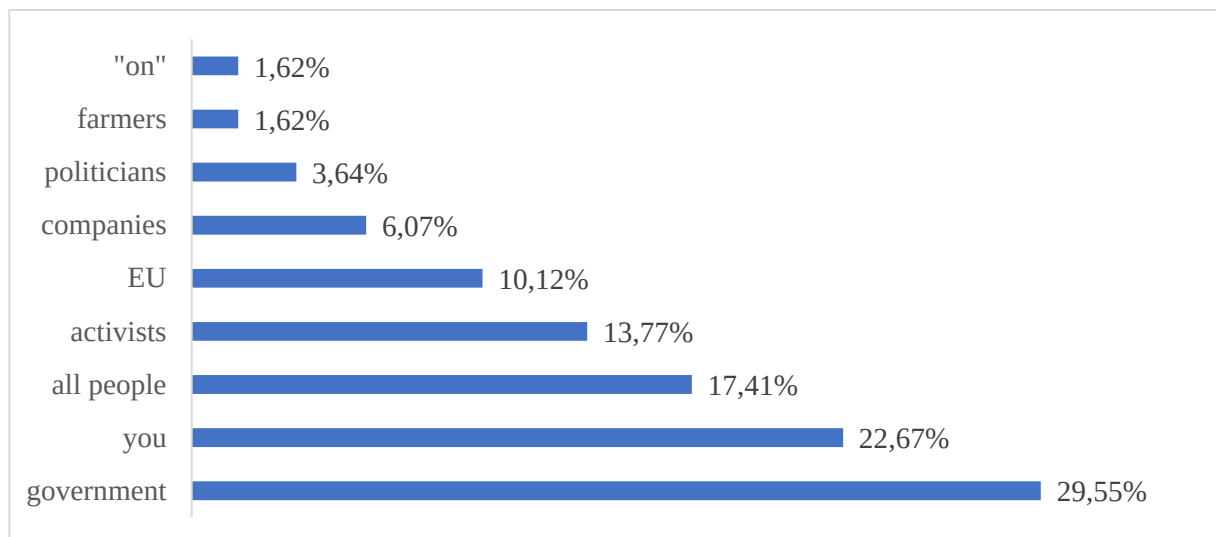


Figure 37 Actors responsible for CC mitigation mentioned in the posts by environmental OLOs in Belgium

Figure 37 illustrates the percentage distribution of occurrences of each actor across posts addressing the food, energy, and transport sectors (N=247). It was observed that multiple actors were often cited as contributors to CC mitigation efforts in the analyzed data. Notably, significant attention was directed towards the government within the corpus of posts by environmental OLs in Belgium, emphasizing the need for support from individuals in particular to sign a petition, attend protesting action, or share the information with other people.

The analyzed posts directly or indirectly introduced the government's responsibility to act. In Figure 38, we introduce an implicit role attributed to the government by Greenpeace, which is introduced in the caption to the post (on the right) "This can't go on! Support our petition to demand a ban on fossil advertising through our link in bio". This demand was directed to the government; however, to do so, the organization needed collective support from its audiences and asked them to follow the link and read more information about the action.



Figure 38 Post by @greenpeace_be, 10.02.2022

6.1.2.3 Obstacles

Compared to the individual discourses of environmental OLs, the organizations mentioned the obstacles more frequently, yet most posts did not specifically mention obstacles or challenges to climate change mitigation. In 72 out of 247 analyzed posts about the three focus themes, we

observed one or two obstacles to CC mitigation. Overall, obstacles appeared in the posts 85 times and were related to corporate misbehavior (N=48), wrong political action (N=26), organizing the action (N=7), money (N=3), and communication (N=1). The percentage equivalents of these numbers are provided in Figure 39.

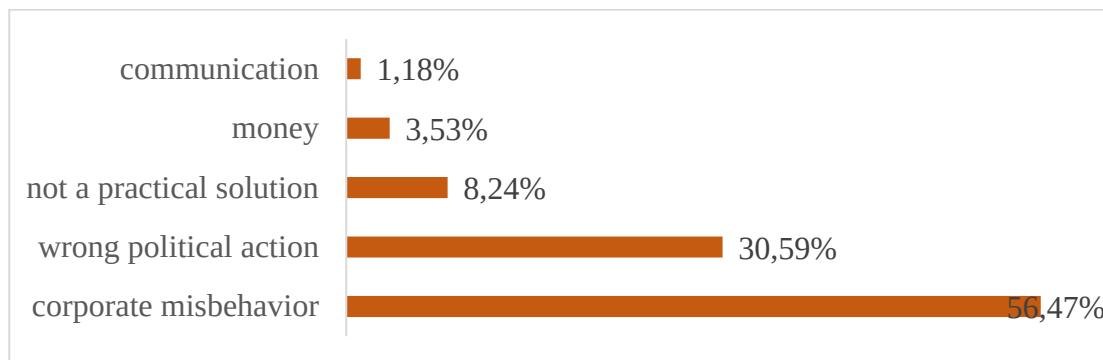


Figure 39 Distribution of obstacles in the posts by environmental OLOs in Belgium, % of the total number of posts containing obstacles

Corporate misbehavior or misconduct was the most common obstacle observed in the posts. It involved companies showing reluctance to contribute to CC mitigation efforts and engaging in environmentally harmful activities, providing a bad example to citizens. For instance, in the post on 20.02.2022, @xrbelgium claims:

“[...] How can you expect citizens to take the environmental crisis seriously when they are confronted everywhere with how **some companies waste energy without restraint**? Such practices should have been banned long ago [...].”

This claim was addressed because the fashion companies illuminated their boutiques at night and, therefore, wasted significant amounts of energy.

Wrong political actions included endorsing controversial agreements, devising plans that conflict with SDGs, and a lack of commitment from governments or politicians to develop sustainable policies. On 1 April 2021, CNCD-11.11.11 directly named “poor governance” a significant obstacle; the organization wrote: “**La mal gouvernance est un frein majeur à l’ambition**”. Ambition here refers to the sustainable practices that should be adapted to achieve SDGs. Climate skepticism of political parties, such as Nieuw-Vlaamse Alliantie, is also mentioned in texts of the posts as the barrier to pro-environmental actions, for example, @ecolobe wrote on 29 October 2021: “☹ Le **climatoscepticisme** de la N-VA tente de bloquer la feuille de route belge à quelques jours de la COP26.”

The obstacle category *not a practical solution* was frequently attributed to the action in the transport sector, where organizations mentioned impractical infrastructures for bike users. Although they suggested solutions that could contribute to the improvements in the sector, they also highlighted the barriers that appear to individuals today, such as grocery shopping or children's transportation not being convenient with a bike, particularly in winter. Ecoconso posted on 23 September 2021 “**Mais le vélo ce serait trop compliqué pour les courses. Pas agréable en hiver. Incompatible avec le transport des enfants. Pas pratique en jupe ou en costume**”. In the post's image, Ecoconso pictured a young father with a baby riding a bike in the city and highlighted the central theme of the post – nine barriers to riding a bike (Figure 40). These barriers are, however, explained on the organization's website, not in the post, and the audience is invited to follow the link to read more information.



Figure 40 Image to a post by @ecoconso, 23.09.2021

Security-related issue regarding the bike parking was also highlighted by @ecolobe on 12 February 2021 writing “**🚲 Pour bien des Bruxellois·e·s, ne pas être sûr·e·s de retrouver son vélo après l’avoir stationné dans un endroit non-sécurisé est un frein pour adopter le deux roues**”.

Money as an obstacle was mentioned in three posts, highlighting the lack of money for citizens to contribute to climate action. Extinction Rebellion wrote on 3 November 2021:

“[...] For years, we were told that we had to adapt our individual lifestyles. Really? You can only get rid of your car when there is decent, affordable public transport. **Not everyone has enough money to insulate their home or buy organic food**, for instance. [...]”.

The *communication* issue in this corpus was attributed to the media that contributed to the controversial debates about nuclear energy and devoted a large number of articles to it while other actions should be communicated about.

The actors criticized for their irresponsible conduct concerning sustainability practices and contributing to the obstacles vary across the analyzed posts. In 24% of posts addressing CC and environment-related matters regarding the food, energy, and transport sectors, the OLOs discussed different obstacles to CC mitigation. However, in the remaining posts, criticism was directed towards specific entities, with the companies or corporations being mentioned in 67 posts, the EU in 15 posts, the government and political leaders in 11 posts, farmers in 7 posts, and everybody or all people in 4 posts. Fossil fuel companies such as *TotalEnergies*, *Shell*, *Chevron*, *BP*, *EDP*, *ENI*, and *ExxonMobil* were the most frequently mentioned companies blamed for their irresponsible actions towards the environment and humanity. The previously discussed post by Greenpeace from Figure 38 illustrates the actions of companies as an obstacle to CC mitigation. The organization blames fossil fuel companies such as *BP* and *TotalEnergies* for their continuous “destroying the climate, damaging our health, and continuing to sell us its products with impunity.” According to Greenpeace, these companies do not attribute sufficient effort to CC mitigation.

6.1.2.4 Values

Among the various environmental values, biospheric and egoistic values were the most frequently encountered in the posts by environmental OLOs. The organizations advocated for environmental protection and pollution prevention in more than 60% of the posts considering food, energy, and transport themes. Out of 247 posts by environmental OLOs in Belgium, egoistic values appeared in 126 posts (51,01%) and altruistic values in 101 posts (40,89%). Additionally, hedonic values were apparent in 29 Instagram posts (11,74%). Further statistics regarding the obstacles discussed in posts by environmental OLs are detailed in Table 19.

Table 19 Observed values in the posts by environmental OLOs in Belgium, % of the total number of posts regarding food, energy, and transport themes (N=247)

Value cluster	Value item	Number of posts in general (in %)		Number of posts concerning obstacle (in %)	
Biospheric		155	62,75%	-	-
	Protecting the environment	102	41,30%	-	-
	Preventing pollution	62	25,10%	-	-
Altruistic		101	40,89%	-	-
	Health of all people	33	13,36%	-	-
	Helpful to others	50	20,24%	-	-
	World at peace	3	1,21%	-	-
	Social justice	30	12,15%	-	-
	Equality	2	0,81%	-	-
Egoistic		126	51,01%	66	26,72%
	Successful	9	3,64%	-	-
	Personal health	2	0,81%	-	-
	Ambitious	11	4,45%	3	1,21%
	Wealth	49	19,84%	21	8,50%
	Influential	29	11,74%	23	9,31%
	Authority	24	9,72%	19	7,69%
	Social power	15	6,07%	10	4,05%
Hedonic		29	11,74%	3	1,21%
	Satisfaction of accomplishment	10	4,05%	-	-
	Comfort	9	3,64%	3	1,21%
	Enjoying life	8	3,24%	-	-
	Pleasure	3	1,21%	-	-

The last column of Table 19 illustrates the values and their frequencies in relation to the obstacles discussed in the Instagram posts. We note that biospheric and altruistic values in this dataset are not directly associated with obstacles to pro-environmental action. However, hedonic and egoistic values and their respective items were directly linked to obstacles in some posts. Egoistic values concerning obstacles were present in nearly 27% of the posts, while hedonic values appeared in 1% of the analyzed data. Among the most frequent value items related to obstacles were *influential*, *wealth*, and *authority*. *Influential* value item here denotes the care about their image transmitted by fossil fuel companies, manipulation of governmental decisions, and negative influence or example transmitted to citizens. *Wealth* in the observed values refers to the importance of possessing the financial resources necessary to contribute to climate action, which is insufficient for some people. *Authority* with obstacles was often referred to as the misuse of power by political figures who neglect their role in mitigating climate change despite it being their responsibility.

Generally, the values were more frequently combined in the posts by environmental OLOs in Belgium. Biospheric value items, such as protecting the environment or preventing pollution, frequently appeared in combination with egoistic value item related to wealth. Hedonic values frequently accompanied altruistic values. For example, some posts discussed the benefits for individuals and satisfaction from an accomplished action, notably if it contributed to the well-being of others. The co-occurrence networks of the values within the same post are illustrated in Figure 41.

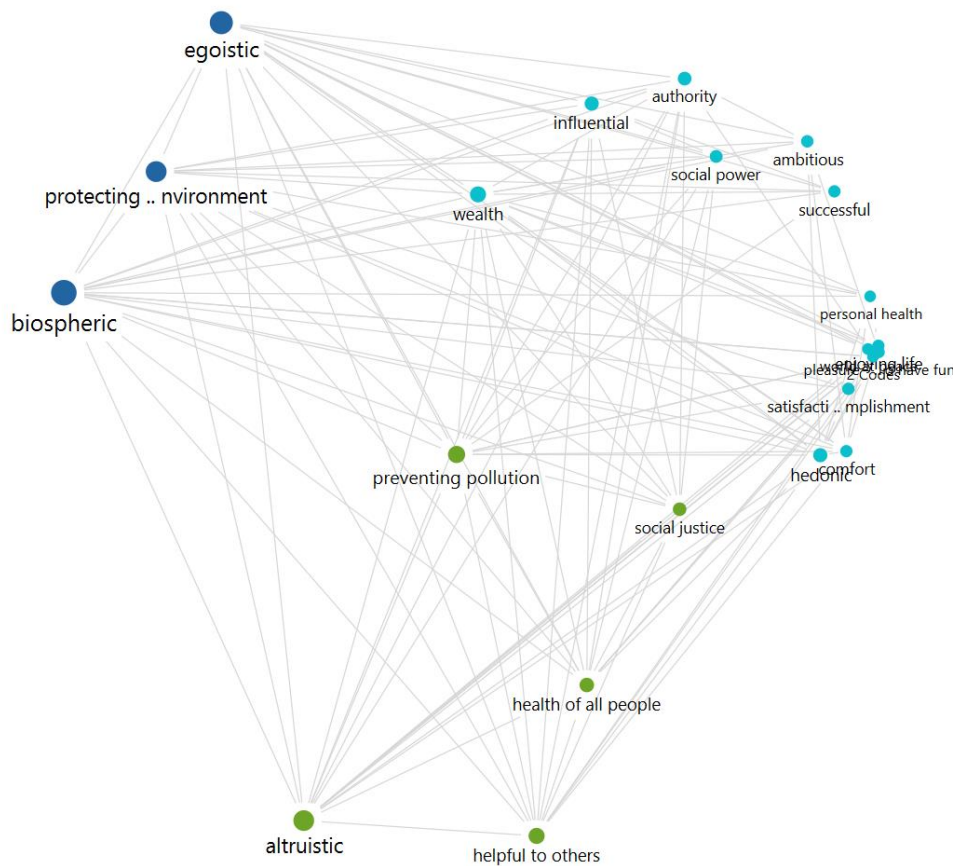


Figure 41 Co-occurrence network of the values in the posts by environmental OLOs in Belgium

The environmental values in the posts by the selected OLOs in Belgium are more frequently pictured in the visual and verbal modes. Nevertheless, biospheric or altruistic values appeared more often in both modes. For example, in the post on 15 March 2021, Extinction Rebellion highlighted the polluting actions by fossil fuel companies in the image by picturing air pollution from power plants and in the text within the image by naming *BNP Paribas* a “most polluting bank in Europe.” This statement was supported by the post’s text on the right from Figure 42.

In addition to this, Figure 42 demonstrates a combination of biospheric and egoistic values. The egoistic value was referred to as the wealth value item, which is more important for banks increasing investments in industries harmful to the environment, such as fossil fuels.



Figure 42 Post by @xrbelgium, 15.03.2021

While most of the egoistic values considering the obstacles are demonstrated in the captions to the posts more frequently than in the visuals, we provide an example where the two modes are interconnected. In a previously discussed post by Greenpeace illustrated in Figure 38, the egoistic value item as wealth is related to the desire to have more profits from putting forward activities harmful to the environment and the planet. Besides wealth, the image of a male person wearing a tie and a suit illustrates the social power of the leaders of fossil fuel companies, who do not contribute to CC mitigation.

To summarize, from our data, the Belgian environmental OLOs focused their communication on sustainability transition, predominantly in the energy sector. The food and transportation sectors were less evoked in the analyzed posts. They particularly emphasized collective actions towards CC mitigation in the energy sector. The government, “you,” and all people were named as the central responsible figures for CC mitigation. At the same time, several actors were criticized for their irresponsible behavior, including companies, the EU, government and politicians, farmers, and all people. The main obstacles to CC mitigation were directly related to the actions of corporations, wrong political actions, organizing the action and

its practicality, money, and communication. Biospheric and egoistic values were mainly present in the analyzed posts, and the values related to the obstacles were egoistic and hedonic.

Belgium: Key Findings

- Food was the most frequently discussed theme by the environmental OLs.
- Energy was the most frequently discussed theme by the environmental OLOs.
- The posts by environmental OLs and OLOs provided a broad spectrum of climate actions within the food, energy, and transport sectors. The most extensive list considered the food sector, and the least extensive was the transport sector.
- The most frequently proposed solutions by the environmental OLs included reducing food waste, developing renewable energies, and using bikes for everyday transportation.
- The most frequently proposed solutions by the environmental OLOs included supporting agriculture, ceasing the use of fossil fuels, and developing public transport infrastructure.
- The environmental OLs and OLOs emphasized the role of government and “you” (the posts’ readers) as main actors for CC mitigation.
- The obstacles in the posts by environmental OLs included wrong political action, corporate misbehavior, feelings of anxiety, lack of money, lack of time, difficulty in doing the action, and not consistent action.
- The obstacles identified in the posts by environmental OLOs included corporate misbehavior, wrong political action, ineffective solutions, and insufficient communication.
- The posts by OLOs mentioned more criticized actors for their inaction toward CC mitigation than the posts by OLs.
- Biospheric values were the most frequent in the posts by environmental OLs and OLOs
- Egoistic and hedonic values were linked to the observed obstacles in the posts by environmental OLs and OLOs.
- In the posts by environmental OLs, the most frequent value items concerning obstacles were wealth, authority, and social power.
- In both subcorpora, the obstacles were more frequently mentioned in the posts’ texts or text-on-image elements, yet sometimes supported by the visuals.

6.2 France

In this part, we introduce the results from multimodal content analysis of the posts in *Corpus21-22_FET*. First, we demonstrate the results from the analysis of the posts by OLs in France (N=640). Second, we assess the results from the analysis of the posts by OLOs in France (N=503). Each part is structured according to the themes of the Codebook questions in the following order: climate change themes, climate actions and actors, obstacles, and values.

6.2.1 Instagram communication by environmental OLs about the sustainability transition in the food, energy, and transport sectors in France

6.2.1.1 CC themes

In 84% of the examined data concerning food, energy, and transportation, French environmental OLs directly²¹ (N=376) or indirectly²² (N=197) addressed CC and environment-related topics. These themes were divided into food-related subjects in 292 posts (51% of the posts addressing CC issues), energy-related topics in 98 posts (17% of the posts addressing CC issues), and transportation-related matters in 83 posts (14% of the posts addressing CC issues). These themes appeared in the posts solely or combined: 418 posts covered at least one of our focus themes. Other themes unrelated to our primary topics of interest were predominant in the 27% of posts focusing on CC and the environment.

At this step, we also distinguished the identified themes regarding the group of environmental OLs. In France, all types of individual enunciators – political leaders, activists, individuals pursuing creative professions, and individuals combining creative profession and social activism – posted predominantly about the sustainability transition in the food sector. Although the transport theme is slightly underrepresented in this data, we noticed that politicians communicated about this theme more frequently than other individuals, i.e., in 34,4% of their posts.

To complement the investigation of the themes, we identified the most frequent words with the *MaxQDA* Wordcloud function with a minimal frequency score equal to 55. These words can be divided into several lexical fields, including climate or environment, food, energy,

²¹ When CC or environment-related topics were explicitly mentioned in the posts

²² When CC or environment-related topics were implicitly suggested in the posts

transport, and other themes. The lexical field considering climate and environment included such words as *nature*, *écologie/ecologie*, *environnement*, *climat*, *écologique*, *climatique*, *durable*, *saison*, *animal*, *écologique*, *pollution*, *naturel*. Words considering the food theme comprised *cuisiner*, *alimentation*, *zerodechet*, *alimentaire*, *manger*, *légume*, *fruit*, *bio*, *viande*, *recette*, *alimentaire*, *agriculture*. The lexical field of the energy sector included two nouns *énergie*, and *gas*. The transport sector is underrepresented in the corpus. The words related to the country of focus entailed *France*, *français*. These keywords from the posts regarding sustainability transition in the food, energy, and transport sectors are visualized in Figure 43.



Figure 43 55 most frequent words from the posts by environmental OLs in France; the minimal frequency is 55

6.2.1.2 Climate actions and actors

After carefully observing the posts considering the food sector, we identified 258 out of 292 posts (88%) discussing solutions in this sector. Although the rest of the posts were somehow linked to the food theme, they did not propose any explicit or implicit action or solution towards sustainability transition in the food sector. **On an individual level**, the proposed solutions were consuming organic products, following a vegetarian food diet, consuming local food, reducing food waste, organizing a home garden, consuming seasonal food, reducing meat consumption,

composting, buying food products in bulk, batch cooking, prioritize home cooking or reduction of take away food from restaurants. Group actions were less frequently discussed in the posts by environmental OLs in France. Five solutions were proposed as **group actions**: refraining from pesticide use in agriculture, offering vegetarian options in school canteens, teaching agroecology, ending intensive animal farming, and financing agriculture. The percentage for each category in relation to the total number of posts considering the food sector is demonstrated in Table 20. In the following paragraphs, we elaborate on each proposed solution.

Table 20 Pro-environmental actions in the food sphere by environmental OLs in France

Action	Number of occurrences	% of analyzed posts about the food sector, OLs
Individual action		
organic products consumption	51	19,77%
following vegetarian diets	49	18,99%
consuming local food	49	18,99%
no food waste	41	15,89%
organizing a home garden	35	13,57%
consuming seasonal food	29	11,24%
reducing meat consumption	24	9,30%
composting	19	7,36%
buying in bulk	14	5,43%
batch cooking	11	4,26%
no takeaway food	9	3,49%
Group action		
no pesticide use by agriculture workers	14	5,43%
vegetarian option in school canteens	11	4,26%
teaching agroecology	5	1,94%
stop intensive animal farming	4	1,55%
financing agriculture	3	1,16%
Total posts about the food sector	258	

Organic product consumption was mentioned in the posts by environmental OLs in France, signifying that individuals need to purchase organic fruits and vegetables that are produced without pesticides and follow organic sustainability standards. This category was frequently used in combination with local food and seasonal food consumption. *Local food* products are produced, processed, and distributed within a relatively close geographic area to where they are consumed. This concept emphasizes supporting local farmers while reducing the distance that food travels. Another means to reduce the distance between the food producer and the consumer is the *consumption of seasonal food*, which refers to the production of ingredients that are naturally available during specific times of the year, typically corresponding to the local climate

and growing seasons. In many posts, the environmental OLs suggested that seasonal foods are often fresher, more flavorful, and more nutrient than their out-of-season counterparts: This highlights the role of hedonic values for the environmental OLs.

Following a vegetarian diet was often combined with a vegan diet. The authors emphasized the need to change our food regimes towards vegetarianism or veganism. They did so by direct claims and by indirect forms of posting vegetarian or vegan recipes and asking whether their followers adopted these diets in their lives. Although *food waste practices* can also be attributed to companies, such as supermarkets, in our data, these actions were mainly attributed to the individuals, which were recommended to minimize the cooking waste throughout the cooking process. *Composting* and *organizing a home garden* are two other solutions repeatedly used in the same post. The OLs discussed their gardening experiences and recommended that their audiences follow this example. *Buying in bulk*, *batch cooking*, and *reducing the consumption of takeout meals* are the categories that can be unified under one category – organizing home cooking. The authors discussed their experiences, asked for advice from their audiences regarding the organization of the cooking practices, and highlighted the necessity to adapt our consumer behaviors to more sustainable practices, such as reducing container waste, preparing multiple servings of meals in advance, and prioritizing home cooking.

While individual actions were framed as recommendations for citizens to adopt, group actions in the food sector were instead addressed to the administrative structures in the form of demand or injunction. *Refraining from pesticide use* in agriculture was used in the posts as a demand to politicians and farmers to adapt agricultural policies to sustainable agricultural practices, such as *ending intensive animal farming*. In some other posts, the environmental OLs named sustainable agriculture practices *agroecology* that should be taught to agriculture workers, yet without providing any concrete example of what agroecology is. To pursue the sustainability tradition and support farmers in such a changing context, the environmental OLs demanded that the government provide more *financial resources for the agriculture sector*. Another collective action was oftentimes suggested by political leaders of green parties: offering vegetarian options in school canteens. These actors used confirming discussions with citizens about vegetarian food options in schools as a part of their electoral campaign.

In the analyzed posts regarding the energy sector in France, we observed **five individual actions** proposed as solutions to the sustainability transition in this sector: reducing energy use,

repairing electric devices, using alternatives to streaming platforms, purchasing solar electric devices, and consuming locally produced energy (Table 21).

Table 21 Pro-environmental actions in the energy sphere by environmental OLs in France

Action	Number of occurrences	% of analyzed posts about the energy sector, OLs
Individual action		
Reduce energy use	11	14,29%
Repair electric devices	5	6,49%
Use alternatives to streaming	2	2,60%
Use solar electric devices	1	1,30%
Consume locally produced energy	1	1,30%
Group action		
Develop renewable energies	28	36,36%
Stop investing in fossil fuels	13	16,88%
No use of nuclear energy	10	12,99%
Optimize building construction	8	10,39%
Stop advertising fossil fuels	2	2,60%
Develop batteries recycling	2	2,60%
Re-think energy infrastructures	1	1,30%
No offshore windmills	1	1,30%
No coal mines	1	1,30%
Support citizens against energy price rise	1	1,30%
Total posts about the energy sector	77	

Reducing energy use refers to minimizing individual energy consumption, such as using less energy while cooking by turning off the oven five minutes before the recommended time or turning off the electricity and electric devices when unnecessary or while leaving the house. Individuals pursuing creative professions or activists provided clear solutions to the reduction of energy use in comparison to politicians more frequently emphasizing energy sobriety (“sobriété dans nos usages”). *Repairing* and using relatively old *electronic devices* is considered sustainable in the energy sector because, according to the environmental OLs, it economizes the energy used to produce a new device. The negative environmental impacts of *streaming* services were highlighted in two posts discussing the high level of energy consumption by the servers connected to streaming platforms. Thus, the authors recommend applying sustainable strategies to streaming practice: watching videos with lower image quality settings, reducing watching video with streaming, or downloading films on devices. In one post, a representative of the creative profession suggested using *solar electric devices* since they support renewable energy use. *Locally-produced energy*, in particular from wind or solar panels, was presented as

a sustainable practice since it creates a demand for renewable energy sources and contributes to the sustainability transition.

At a group level, the environmental OLs directly addressed primarily their demands to the government. They asked for the *development* and financial support of *renewable energies*, such as wind or solar energy. This action was often opposed to *ceasing investments in fossil fuel companies*, *banning fossil fuel advertisements*, *reduction of nuclear and coal energy shares* in energy production. The *optimization of new buildings' construction* and the adaptation of the existing buildings to new standards in housing insulation were also recommended to reduce energy use, and they were directly addressed to governments and construction companies. Although renewable energies are always represented as a solution to CC mitigation, other actions should be taken to optimize this process, including *developing battery recycling* and *avoiding offshore wind farms* (wind turbines installed in seas or oceans to generate electricity from wind energy). The beginning of the war in Ukraine caused an energy crisis, and thus, energy prices rose in Europe, which resulted in the demands on the government to support citizens financially against the rise in the energy price.

The transport sector is less represented in our data: 70 out of 83 posts proposed solutions to CC mitigation in this sector. At the individual level, they recommended prioritizing bike transportation, sustainable traveling, reducing individual car use, using public transport, co-driving and car-sharing, reducing individual travel by plane, more frequent walking, and using electric vehicles (Table 22).

Table 22 Pro-environmental actions in the transport sphere by environmental OLs in France

Action	Number of occurrences	% of analyzed posts about the transport sector, OLs
Individual action		
Use more bikes	15	23,44%
Sustainable travel	11	17,19%
Reduce individual car use	9	14,06%
Use of public transport, trains	9	14,06%
Practice co-driving and car-sharing	8	12,50%
Reduce individual travel by plane	8	12,50%
Walk more	6	9,38%
Use electric vehicles	3	4,69%
Group action		
Improve public transport infrastructure	15	23,44%
Make public transport accessible and affordable	12	18,75%
Improve cycling infrastructure	5	7,81%
Provide subsidies to buy electric bikes	3	4,69%
Develop and improve walking infrastructures	3	4,69%
Educate about transport sustainability	2	3,13%
Improve batteries of electric vehicles	1	1,56%
Stop advertising polluting vehicles	1	1,56%
Electrify public transport	1	1,56%
Total posts about the transport sector	70	

Many environmental OLs showed their personal example of *going to work by bike* in the posts' texts and images and recommended their followers to adapt their everyday transportation to the use of non-motorized transport. *Sustainable travel* was another large focus category for environmental OLs and signified compensation for CO2 emissions from air travel and following slow and green traveling practices. These practices may include prioritizing quality over quantity while traveling, seeking authentic experiences connecting with local culture, choosing local destinations for vacations, and minimizing adverse effects on local communities. These practices could contribute to *reducing airplane travel*, which was discussed less frequently in the posts. *Reducing individual car use* in the analyzed posts was intertwined with *car sharing* and *co-driving* practices and the *use of public transport* instead of personal car. Indeed, in many posts, these two types of transport are frequently opposed to each other. *Prioritizing walking* for short destinations was also mentioned as a solution to sustainability transition in the transport sphere at an individual level. Only three posts discussed the *use of electric vehicles*. They did so by providing personal examples of travel by electric car and statistical information about the benefits of this mode of transport for the environment.

At the **group or collective level** regarding sustainability transition in the transport sector, we identified such solutions as accessible and affordable public transport, improvement of public transport infrastructure, providing subsidies to purchase electric bikes, improvement of cycling and walking infrastructures, developing transport sustainability education, improving batteries of electric vehicles, ceasing advertising of polluting vehicles, electrification of public transport (Table 22).

Regulation of public transport by *improving the infrastructure* and making *public transport more accessible and affordable* was mentioned in the majority of the posts by environmental OLs. This action was expressed as a direct demand to the government and the leading railway company, *SNCF*. Besides public transport regulation, individuals asked the government to provide *subsidies for electric bikes* and *improve cycling and walking infrastructures*. These actions by the government and local administrations would help citizens reduce their car use. *Education about transport sustainability* included providing information, raising awareness, and fostering understanding about the sustainability transition in transportation. Environmental OLs highlighted the necessity to *electrify transport*; however, some improvements should be made prior to the transition to electric vehicles' use, such as *improving the capacities of electric vehicles' batteries* and *ceasing the advertising of polluting means of transport*.

In the posts by environmental OLs in France, the responsibility to act for the climate is allocated to different actors. These actors are illustrated in Figure 44, where the percentage is calculated in relation to the total number of posts considering the food, energy, and transport sectors (N=418). Different individuals – “me-myself” and “you,” the audience – embodied the highest percentage of responsibility, underscoring the significance of individual climate action. The category “all people” represented a broader societal contribution to CC mitigation practices. Furthermore, governmental bodies and corporate entities were identified as key stakeholders to contribute to CC mitigation. Politicians and activists, with their roles in policy-making and advocacy, also commanded a significant share of responsibility, reflecting the intersection of political will and social mobilization in driving climate action. Notably, peripheral contributors such as the EU, agricultural practitioners, and educational institutions,

though allocated smaller proportions, nonetheless play indispensable roles in the broader responsibility for climate action.

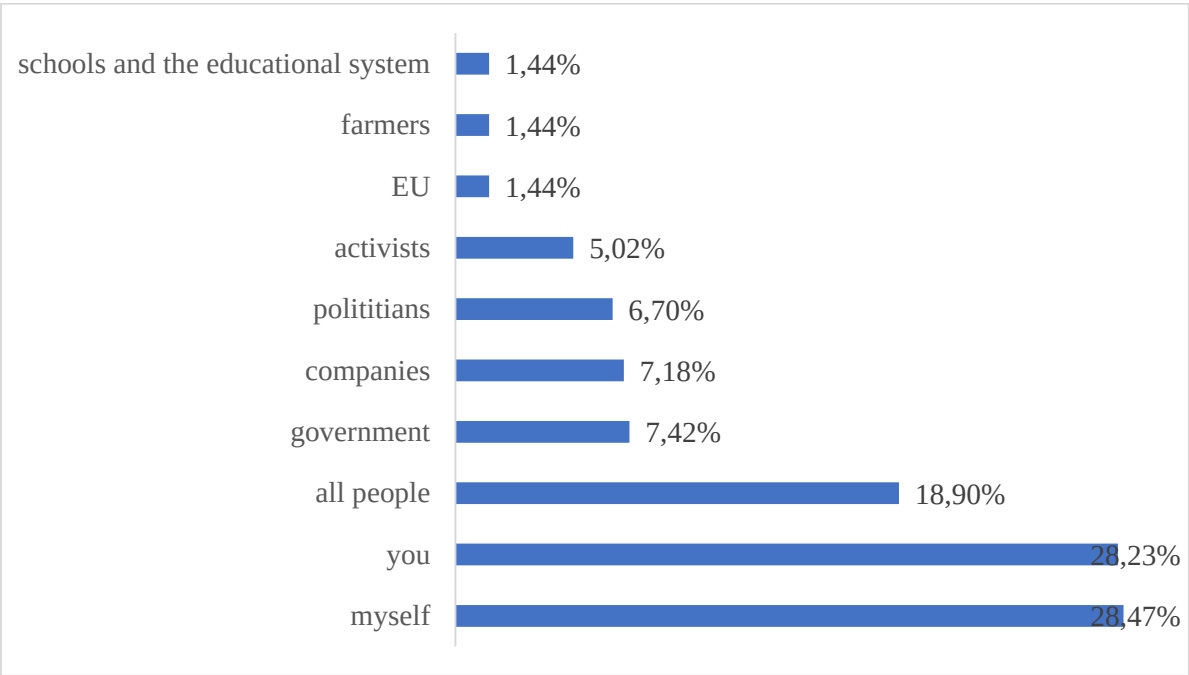


Figure 44 Actors responsible for CC mitigation mentioned in the posts by environmental OLs in France

6.2.1.3 Obstacles

In most posts regarding CC and environment-related topics in relation to food, energy, and transport, the environmental OLs did not specifically mention particular obstacles or barriers to CC mitigation. In the remaining posts (21,46%), we observed the following obstacles: organizing the action, corporate misbehavior, wrong political action, organizing the action, communication and knowledge, personal feelings and emotions, social judgment, money, and stereotypes. The percentages of each category in relation to the total number of posts mentioning the obstacles (N=123) are demonstrated in Figure 45. In the following paragraphs, we describe each obstacle in detail.

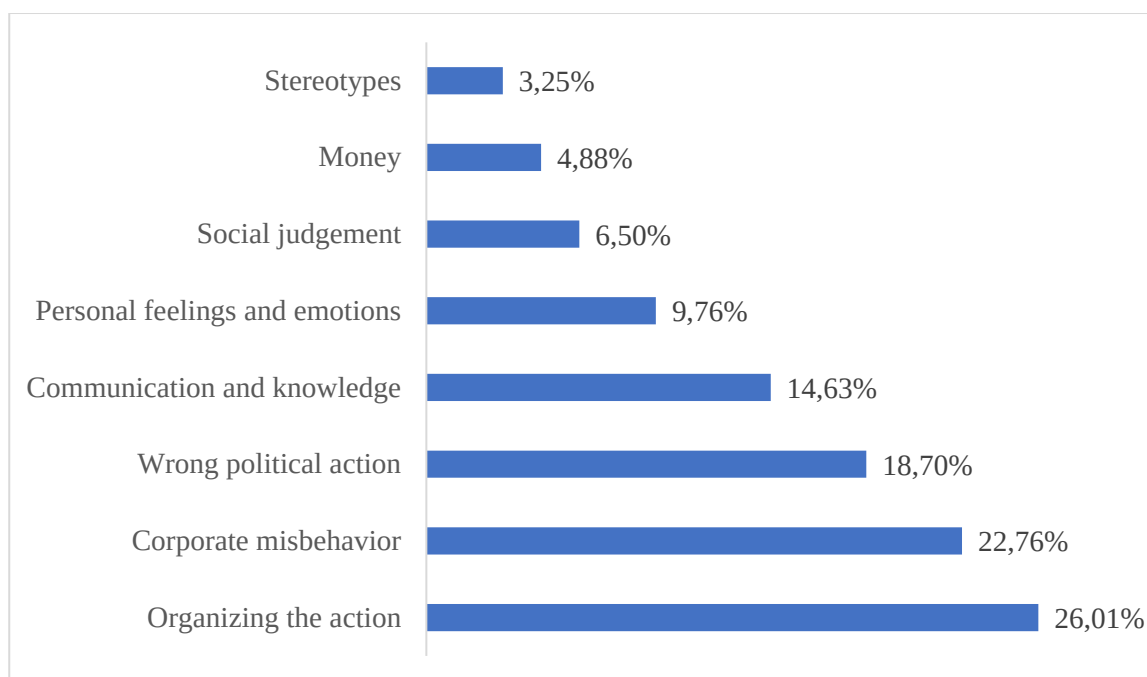


Figure 45 Distribution of obstacles in the posts by environmental OLs in France, % of the total number of posts containing obstacles

Organizing the action was the most frequently mentioned category of obstacles predominantly related to the individual reasons linked to different conditions as barriers to CC mitigation. Among this category of obstacles, we identified the unwillingness to act due to personal difficulties and the effortful nature of a pro-environmental action, unwillingness to spend extra time on pro-environmental actions, perfectionism, which blocks certain actions because the person does not want to do it otherwise but perfect, and unwillingness to consume same food products all the time. The last example was mainly attributed to the adaptation of vegetarian food diets. One more example of the obstacle in organizing the action group was related to the collective idea of contributing to CC mitigation: the unwillingness to contribute because other people do not do so. While perfectionism was oftentimes mentioned as an example of personal unwillingness to act, the other categories were mainly attributed by the environmental OLs as obstacles for other people.

Corporate misbehavior referred to companies' reluctance to contribute to CC mitigation efforts and their tendency to engage in environmentally harmful activities, such as increasing investments in fossil fuels or greenwashing.

Wrong political action in the analyzed posts mainly referred to signing controversial documents, developing plans contradicting the established SDGs, and developing controversial

or insufficient sustainable policies by the French government and political leaders. For example @ecotalkfrance wrote on 6 November 2021 “La France **refuse d’arrêter de financer les énergies fossiles.**” This obstacle was frequently linked to the actions of politicians, such as President Macron, whose decision not to stop financing fossil fuel industries seemed incomprehensible to the post’s author (Figure 46). Another example of wrong political action is linked to insufficient measures for sustainability transition at the local administration level. For example, @wdEjOy wrote²³ “La région IDF propose déjà un système de location avec @veligo_loc ainsi que des primes pour l’achat d’un vélo. C’est un bon début **mais** c’est vraiment **insuffisant** ! 😞.”



Figure 46 post by @ecotalkfrance, 06.11.2021

Communication and knowledge reflected the negative role of misinformation on climate action, lack of information about the proposed concrete solutions in different spheres of life, or

²³ By the time of the writing, the account was changed to private. In this work, we pseudonymized the selected account.

receiving controversial information about sustainability transition, which confused authors and other people cited by them and did not motivate them to act.

Personal feelings and emotions were mainly mentioned as personal examples, where authors described their feelings of anxiety, fear, or guilt for not doing sufficient climate action, which can be demotivating, according to them.

Social judgment can be connected to personal feelings and emotions and serve as demotivation to act because their actions are not valued by society and are judged or criticized by others. @les_petits_ecolos wrote on 28 November 2021:

“Le plus dur, c’est de devoir se justifier, expliquer, encore une fois, à ceux qui veulent savoir, mais pas vraiment en fait. Pourquoi tu te fais chier à faire tes conserves, t’en as plein l’rayon? Pourquoi tu te privas de viande et pourquoi tes fringues sont d’occasion? C’est crade! C’est extrémiste ton mode de vie !”

Although this personal example of judgment by others can be discouraging, the author further criticized others for not contributing to CC mitigation and emphasized the role of individual choices for the benefit of the planet and the people on it.

The money category of obstacles was attributed to the posts suggesting that CC mitigation efforts are expensive for certain population categories. As such, environmental OLs stated that purchasing organic products or buying in bulk can be expensive for some citizens. It can be illustrated by an extract from a post by @c.lairdutemps “De fait, mettre une image de bocaux, de courses en vrac etc... est certainement élitiste dans le sens où une partie de la population doit avant tout se préoccuper de serrer le cordon pour que ça rentre” on 19 January 2021.

Stereotypes were mainly used as “justification” by other people for not contributing to climate action. These stereotypes were majorly related to the consumption of meat, which certain people justify as “people have always been eating meat” or “vegetarian food diets contribute to the lack of iron.”

The entities responsible for challenges to CC mitigation, or those being reproached for their lack of contribution to the sustainability transition, included different group and individual actors. However, they were not often mentioned in the posts by environmental OLs: in only 83 out of 418 analyzed posts about the sustainability transition in the food, energy, and transport sectors. Among these actors, we identified various companies, governments, politicians, all people, “anti-écologues,” and the EU.

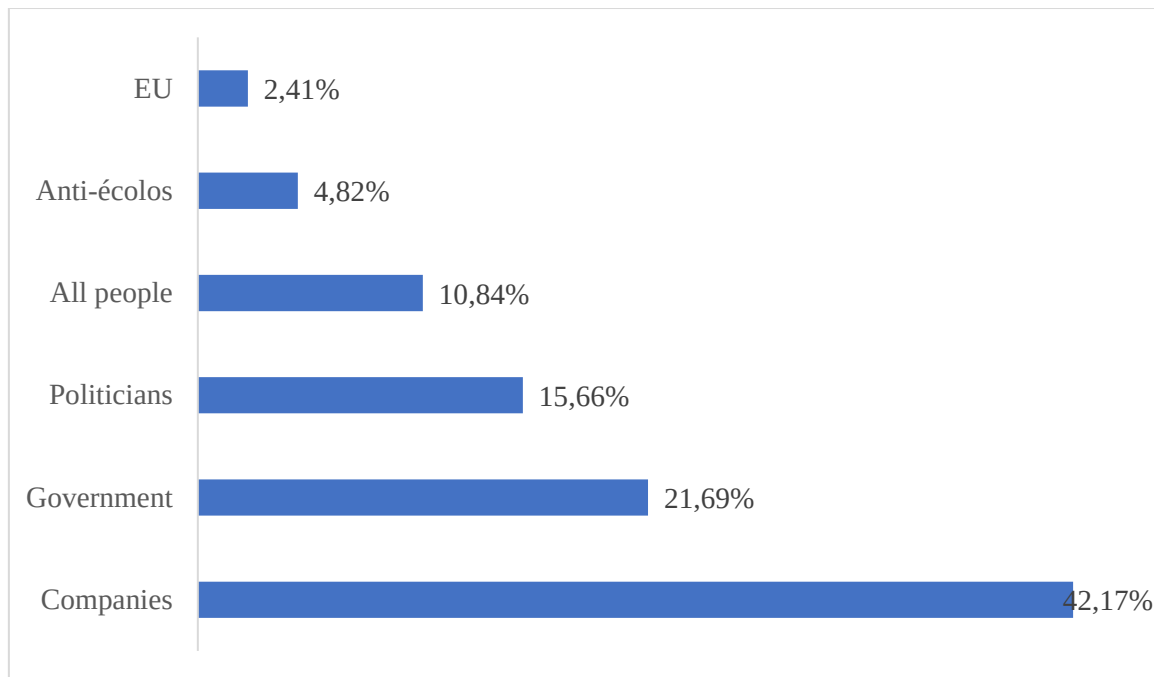


Figure 47 Distribution of criticized entities in the posts by environmental OLs in France, % of the total number of posts identifying criticized figures

The most frequently criticized *companies* for their irresponsible position toward CC mitigation were *Amazon, Auchan, BNP Paribas, EDF, Hello Fresh, Lufthansa, Total, and Tupperware*. Other criticized companies or industries were generalized as agriculture lobbies or meat lobbies. For example, @ecotalkfrance wrote in their image posted on 12 Mars 2022 “**Les lobbies de la viande** s’infiltraient partout, pour nous pousser à consommer toujours plus de viande”.

The government was mainly criticized in the posts for its inaction towards CC mitigation or for the adaptation of controversial policies, as shown in the example above when the government attributed natural parks to the construction of offshore windmills. The leaders of the governments, such as President Macron (mentioned in eight posts), President of the Regional Council of Île-de-France Valérie Pécresse and President Putin were also criticized for their position towards sustainability transition.

In some posts, the environmental OLs emphasized the collective responsibility of *all individuals* to contribute to negative environmental impacts. For example, @lespetitsgestes wrote on 31 March 2021:

“**Nous** avons construit la vie meilleure, **nous** avons jeté nos pesticides à l’eau, **nous** fumées dans l’air, **nous** avons conduit trois voitures, **nous** avons vidé les mines, **nous** avons mangé des fraises du bout monde, **nous** avons voyagé en tous sens, **nous** avons

éclairé les nuits, **nous** avons chaussé des tennnis qui clignotent quand on marche, **nous** avons grossi, **nous** avons mouillé le désert, acidifié la pluie, créé des clones, franchement on peut dire qu'**on s'est bien amuses.**”

In this message, the author highlighted multiple actions by all individuals negatively influencing nature and the environment in a satirical form.

Anti-écolos, or people criticizing other individuals who actively contribute to CC mitigation, were criticized in some posts by environmental OLs. These critics were mainly related to the social judgment represented as an obstacle to pro-environmental action.

The *EU* was mainly criticized for taxonomy policies and for naming certain fossil fuels as green energies.

6.2.1.4 Values

In the posts by environmental OLs in France, the most prevalent environmental values were biospheric values. Regarding the biospheric value, present in 42,82% of analyzed posts, the environmental OLs asserted the importance of unity with nature, respecting the planet Earth, environmental protection, and preventing pollution. Egoistic values were observed in 137 posts (32,78%), representing the second most frequent value cluster. This category included the importance of wealth, personal health, ambitions, authority, personal influence, social power, social recognition, and success. Among the posts containing the altruistic value cluster (present in 31,82% of analyzed posts), the environmental OLs claimed the necessity of being helpful to other people, social justice, remaining in good health for everyone, equality, and the world at peace. Hedonic values, specifically the importance of satisfaction from an accomplished task, enjoying life, inner harmony, comfort, pleasure, and excessive gratification of one's own desires, appeared in 102 Instagram posts, which is equivalent to 24,40%. Detailed statistics concerning the values that appeared in the posts by environmental OLs are explained in Table 23.

Table 23 Observed values in the posts by environmental OLs in France, % of the total number of posts regarding food, energy, and transport themes (N=418)

Value cluster	Value item	Number of posts in general (in %)		Number of posts concerning obstacles (in %)	
Biospheric		179	42,82%	-	-
	Unity with nature	2	0,48%	-	-
	Respecting the Earth	8	1,91%	-	-
	Protecting the environment	99	23,68%	-	-
	Preventing pollution	90	21,53%	-	-
Altruistic		133	31,82%	-	-
	Health of all people	14	3,35%	-	-
	Helpful to others	101	24,16%	-	-
	World at peace	3	0,72%	-	-
	Social justice	22	5,26%	-	-
	Equality	4	0,96%	-	-
Egoistic		137	32,78%	28	6,70%
	Successful	2	0,48%	-	-
	Social recognition	10	2,39%	-	-
	Personal health	21	5,02%	-	-
	Ambitious	20	4,78%	3	0,72%
	Wealth	50	11,96%	6	1,44%
	Influential	14	3,35%	4	0,96%
	Authority	20	4,78%	10	2,39%
	Social power	11	2,63%	7	1,67%
Hedonic		102	24,40%	5	1,20%
	Inner harmony	9	2,15%	1	0,24%
	Satisfaction of accomplishment	36	8,61%	-	-
	Comfort	9	2,15%	3	0,72%
	Self-indulgent	9	2,15%	-	-
	Enjoying life	31	7,42%	-	-
	Pleasure	9	2,15%	1	0,24%

The last two columns of Table 23 demonstrate the occurrences of values concerning the obstacles to pro-environmental behavior. Biospheric and altruistic values in this data are not connected to the obstacles to pro-environmental efforts in the food, energy, and transport sectors. Hedonic and egoistic value clusters and their items were explicitly or implicitly related to the obstacles in several posts. Egoistic values in relation to obstacles appeared in almost 5% of the posts, and hedonic values appeared less than in 1% of the analyzed data. The most frequent value items concerning obstacles were authority, social power, wealth, personal influence, and ambitions. *Authority* signified the importance of their position within society by political actors, which was sometimes used in contradiction to the SDGs. *Social power*

concerned the importance of having control by companies and their leaders, who could use it to influence CC mitigation policies negatively. *Wealth* signified the importance of money, generally insufficient for certain individuals, to contribute to climate action. *Personal influence* referred to the importance of having an impact, which, in this case, contributed to the inaction of certain people. *Ambitions* in this subcorpus were attributed to the lack of importance or desire for achievement or unwillingness to work towards sustainability transition due to different reasons.

The hedonic value cluster mainly represented the significance of comfort, inner harmony, and pleasure for individuals. The individuals highlighted that uncomfortable conditions of doing the action could demotivate them or other individuals to continue efforts to CC mitigation. Inner harmony and pleasure were used in relation to personal feelings and emotions as a barrier to CC mitigation at an individual level.

The values concerning the obstacles were challenging to identify: they could be frequently combined in one post, and their identification depends mainly on the researcher's interpretation. In one post by @ecolo_mon_cul (Figure 48), the author highlighted the lack of motivation from the government, President Macron in particular, and constantly decreasing ambitions to reduce greenhouse gas emissions (ambitious value item). However, it can also be related to the satisfaction of accomplishment value item of the hedonic value cluster, yet the main idea here is linked to the goal achievements, and therefore, we attributed "ambitious" (or rather "not ambitious") value item.



Figure 48 Extract from a post by @ecolo_mon_cul, 17.02.2021

In our data, we observed different combinations of environmental values within the same post: Figure 49 illustrates these co-occurrence networks. It demonstrates how biospheric, and egoistic value clusters and their items, such as preventing pollution, protecting the environment, personal health, and wealth, are close to each other in the analyzed data. In fact, these values were more frequently utilized in combination within one post.

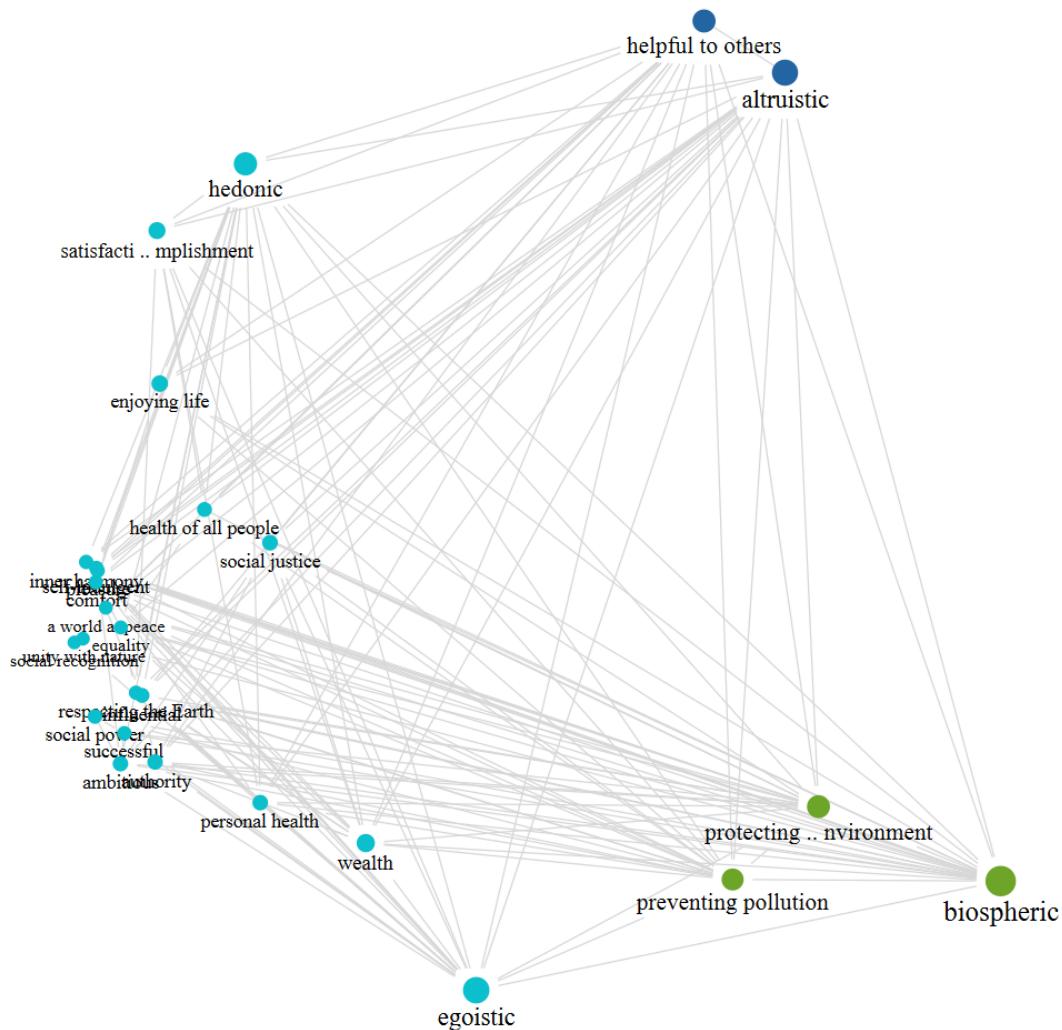


Figure 49 Co-occurrence network of values in the posts by environmental OLs in France

To summarize, the environmental OLs in France posted predominantly about the sustainability transition in the food sector in 2021–2022. The most discussed solutions to CC mitigation were the consumption of organic food products, the development of renewable energies, and the improvement of public transport infrastructures. Different individual actors were identified as responsible for CC mitigation: the posts’ authors, their readers, and everybody. Critics and

obstacles were not largely present in the posts. The most frequent obstacles mentioned were related to the organization of the action, corporate misbehavior, and wrong political action. The biospheric values were predominant in the analyzed posts, often in combination with other values within the same post. The values concerning obstacles were related to the egoistic and hedonic value clusters and their items.

6.2.2 Instagram communication by environmental OLOs about the sustainability transition in the food, energy, and transport sectors in France

6.2.2.1 CC themes

The environmental OLOs in France discussed directly²⁴ (N=388) or indirectly²⁵ (N=33) topics concerning CC issues, corresponding to 83,70% of the posts by French OLOs from the *Corpus21-22_FET*. They addressed food-related themes in 34% of posts considering CC issues. Energy-related subjects were discussed in 126 posts (30% of posts considering CC issues). Transportation-related issues were mentioned in 81 posts, i.e., 19% of posts considering CC issues in this subcorpus. Among 25,89% of posts concerning CC and environmental topics in *Corpus21-22_FET*, other themes unrelated to our target subjects were also identified. Overall, since some posts combined two or three themes. The number of posts considering food, energy, and transport themes was 313.

²⁴ When CC or environment-related topics were explicitly mentioned in the posts

²⁵ When CC or environment-related topics were implicitly suggested in the posts



Figure 50 60 most frequent words from the posts by environmental OLOs in France; the minimal frequency is 40

To complement this thematical observation, we extracted the most frequent keywords of the posts' texts in *MaxQDA* and visualized the 60 most frequent words with a minimal frequency equal to 40. This manipulation allowed us to identify several lexical fields, such as climate and environment, food, energy, transport, France, and Europe, which are relevant to our research questions. The lexical field regarding climate and environment theme included the following words *climat*, *climatique*, *environnement*, *écologie*, *pollution*, *durable*, *nature*, *planète*, *animal*, *saison*, *transition*, *biodiversité*, *environnemental*, and *protéger*. The words related to the food theme are *bio*, *agriculture*, *alimentaire*, *alimentation*, *agricole*, *zerodechet*, *pesticide*, and *viande*. The lexical field of the energy sector incorporated such words as *énergie*, *gaz*, *fossile*, and *renouvelable*. The transport theme is less represented in the corpus, and two more frequent words are *transport* and *train*. The words considering the country of focus incorporate *France*, *français*, *pays*, and *fr*. The European context was highlighted with the words *européen* and *Europe*.

6.2.2.2 Climate actions and actors

Upon thorough examination of the posts, 124 out of 145 posts were selected as communicating about the solutions within the food sector. While the rest of the posts touch on the food theme to some extent, they do not indicate any clear efforts to CC mitigation within the food industry. The proposed solutions can be divided into individual and group actions, whose numbers of

occurrences are illustrated in Table 24. **Individual actions** included organic products consumption, consumption of local food, following a vegetarian food diet, reducing meat consumption, consuming sustainable food, consuming seasonal food, reducing food waste, buying in bulk, eating more vegetables, local meat consumption, subscription to organic food baskets, and reducing take away meals. **Group or collective efforts** were represented by ceasing pesticide use, developing agroecology, composting, guaranteeing the rights for food, financing agriculture, ceasing intensive animal farming, re-thinking agriculture, proposing vegetarian option in school canteens, and withdrawing the Common Agricultural Policy (CAP). These proposed solutions to CC mitigation are overviewed in the following paragraphs.

Table 24 Pro-environmental actions in the food sphere by environmental OLOs in France

Action	Number of occurrences	% of analyzed posts about the food sector, OLOs
Individual action		
consuming organic products	16	12,90%
consuming local food	15	12,10%
following a vegetarian food diet	13	10,48%
reducing meat consumption	12	9,68%
consuming sustainable food	8	6,45%
consuming seasonal food	7	5,65%
reducing food waste	7	5,65%
buying in bulk	6	4,84%
eating more vegetables	6	4,84%
consuming local meat	4	3,23%
subscribing to organic food baskets	4	3,23%
no takeaway food	1	0,81%
Group action		
refraining from pesticide use	17	13,71%
developing agroecology	9	7,26%
composting	6	4,84%
guarantee right for food	5	4,03%
financing agriculture	4	3,23%
no intensive animal farming	3	2,42%
re-thinking agriculture	3	2,42%
vegetarian option in school canteens	2	1,61%
withdrawing the CAP	1	0,81%
Total posts about the food sector	124	

Organic and *local food* consumption were two more frequently proposed solutions in the food sector. They were communicated in the same posts by many organizations. Some organizations

endorsed *subscription to organic food baskets*, which could simplify or optimize grocery shopping. This simplification is directly related to the hedonic value item of comfort.

Three other solutions were often used within the same posts: *reducing meat consumption*, *pursuing vegetarian diets*, or *consuming local meat*, which was promoted instead of imported meat consumption. In some posts, the environmental OLOs discussed *increasing the consumption of vegetables* by individuals as a possible solution to CC mitigation, yet vegetarian food diets were not specified in these posts.

Although many individual actions are concrete and well-detailed, we observed a somewhat vague category of solutions, such as consuming *sustainable food*, in eight posts. In these posts, the authors did not specify what sustainable food or products were.

Consumption of seasonal food was highlighted in several posts as a means to reduce transportation distance between the food producer and the consumer. In some posts, it was coupled with organic and local food consumption.

In this subcorpus, reducing *food waste practices* were attributed to the individuals recommending them to minimize the cooking waste throughout the cooking process. To motivate people to contribute to this action, many organizations posted food recipes with ingredients, including leftover food products – “des recettes anti-gaspi.”

Buying in bulk and *reducing the purchase of takeout meals* can be unified under one category – organizing home cooking. According to the environmental OLOs, the practices can significantly reduce container and packaging waste.

As in the case of environmental OLs in France, the organizations tended to frame individual practices as recommendations and collective solutions as demands addressed to the government and agriculture industry. Six of the suggested solutions were directly related to the agriculture sector. *Refraining from pesticide use* was addressed to politicians and farmer workers as a request for better management of agricultural policies and in the form of a demand to *stop intensive animal farming*. In several posts, the environmental OLOs emphasized the necessity of developing *agroecology* and *re-thinking current agriculture practices* in general, i.e., without specifying what they could be. However, *providing financial support* to the agriculture sector and *withdrawing the CAP* were discussed as more concrete actions addressed to the government and the EU.

Two more group actions were directed at the government: *guaranteeing the right for food* for citizens in difficult financial situations and proposing *vegetarian options in school*

canteens. In some posts by EELVFR, a green political party, the authors discussed the debates around the adaptation of vegetarian menus in school canteens in Lyon.

While the individual environmental OLOs highlighted composting practices as individual efforts to CC mitigation, the organizations emphasized the necessity of organizing collective bio-waste collections or *compost* bins in almost 5% of the posts, considering the efforts in the food sector.

From 118 posts considering energy themes by environmental OLOs in France, we selected 101 posts proposing solutions to sustainability transition in this sector. Specifically, we distinguished two individual actions and ten collective actions proposed as solutions to the sustainability transition in this sector (Table 25). We overview each of the proposed practices in the paragraphs below.

Table 25 Pro-environmental actions in the energy sphere by environmental OLOs in France

Action	Number of occurrences	% of analyzed posts about the energy sector, OLOs
Individual action		
reducing energy use	19	18,81%
energy from wood-burning	1	0,99%
Group action		
stop investing in and producing fossil fuels	34	33,66%
develop renewable energies	24	23,76%
optimize building construction	9	8,91%
stop using and developing nuclear energy	6	5,94%
stop advertising fossil fuels	3	2,97%
improve energy transition	3	2,97%
no export of radioactive waste	2	1,98%
resolve energy insecurity	2	1,98%
decarbonize energy	2	1,98%
develop alternative batteries for renewable energies	1	0,99%
Total posts about the energy sector	101	

Reducing energy use on the individual level was promoted in multiple posts by environmental OLOs. On the one hand, organizations like Greenpeace and Réseau Action Climat highlighted the general need for *energy efficiency* (“*efficacité énergétique*”) and *energy sobriety* (“*sobriété énergétique*”). On the other hand, some posts by @cestbonpourlaplanete provided concrete tips and actions on an individual household level, for instance, closing exterior shutters at night, insulating the house, and prioritizing energy-efficient electric devices. These actions are closely

related to the *optimization of building construction*, which was mainly addressed to the government and companies in multiple posts.

In one post, authors discussed energy produced from burning forest biomass, such as wood, as carbon neutral and invited their readers to read more information about it on the website.

Most posts about the energy transition discussed themes connected to fossil fuels, nuclear energy, and renewable energy. *Fossil fuels and nuclear energies* were demanded to have *less financial support* from the government, *cease the development of new pipelines and nuclear energy plants*, *cease the export of radioactive waste*, and *stop advertising* their harmful to nature products. On the contrary, *renewable energies* need to be *developed in general* and by improving or proposing *alternative energy storage solutions* for renewable energy sources in particular.

Energy transition, decarbonization of energy, and *finding solutions to energy insecurity* were generalized in the posts without providing specific details about the concrete actions.

Solutions to the sustainability transition in the transport sector were observed in 67 out of 81 posts considering CC mitigation. Table 26 illustrates that most of the actions for sustainability transition in the transport sector at **an individual level** aim to *reduce car and airplane use* by providing different alternatives. For city transportation, the OLOs suggested *prioritizing riding a bike and walking, using public transport*, particularly *trains*, or *using other non-motorized transport* means such as scooters or skateboards. These two means of transport were frequently expressed by emojis such as 🚲 or 🛹. If it is not possible to reduce car transportation, the OLOs recommended to follow *co-driving* or *co-sharing* practices. To reduce travel by airplane and, therefore, the amount of CO₂ emissions per person, the OLOs suggested prioritizing traveling to long destinations in Europe by train. A vague and unexplained solution, *sustainable travel*, was suggested in one post only.

The actions considering **group efforts** were directly related to the individual actions and included improving public transportation on different levels. To promote cycling, city administrations need to *improve cycling infrastructure* and provide *more space for bikes on the trains*, which can be helpful for inter-city transportation. Reducing individual car use can benefit from government policies, such as a *ban of fossil fuel cars* and a *ban of palm oil fuels used for cars* imported from other countries. Government *collaboration with Google Maps on prioritizing eco-responsible means* of transport by the application was suggested as one of the

concrete actions in reducing car use and developing public transport. *Public transport* needs to be adapted to this transition, in particular by *improving infrastructures*, *providing more options for public transport*, and using *alternative fuels*, such as hydrogen, for public transportation. To motivate people to travel less by airplane, governments were encouraged to *reduce the number of airport extensions*. Finally, a less frequently mentioned solution was the development of *sustainable travel*, which was not described in detail. Table 26 shows the numbers of appearances of each individual and group action.

Table 26 Pro-environmental actions in the transport sphere by environmental OLOs in France

Action	Number of occurrences	% of analyzed posts about the transport sector, OLOs
Individual action		
use more bikes	12	17,91%
use of public transport, trains	15	22,39%
reducing individual travel by plane	8	11,94%
walking more	5	7,46%
co-driving, car-sharing	4	5,97%
airplane to train	3	4,48%
use of non-motorized transport	3	4,48%
reducing individual car use	2	2,99%
sustainable travel	1	1,49%
Group action		
improvement of cycling infrastructure	10	14,93%
no airport extensions	6	8,96%
sustainable transport	5	7,46%
no fossil fuel cars	5	7,46%
development of public transport infrastructure	3	4,48%
hydrogen fuel for public transport	2	2,99%
more space for bikes in trains	2	2,99%
no palm oil fuel for transport	1	1,49%
visualizing eco-transport in Google Maps	1	1,49%
Total posts about the transport sector	67	

As we can see from Table 24, Table 25, and Table 26, the solutions to the sustainability transition in the three sectors appeared 405 times in the analyzed posts. In fact, multiple actions considering different sectors were introduced together in the majority of the posts. Overall, the solutions and actors responsible for CC mitigation appeared in 283 posts.

As discussed in the previous paragraphs, several actions contributing to CC mitigation were directed to the government, which was mentioned as responsible for CC mitigation in 22% of the analyzed posts considering food, energy, and transport themes. Nevertheless, the most

frequently mentioned actors responsible for climate efforts in the posts by environmental OLOs were “you” or “vous” in French, which means that organizations attributed the actions to their audiences in most cases. Other actors responsible for CC mitigation were all people, activists, companies, farmers, environmental OLOs themselves, politicians, the EU, “on” (a French pronoun which can have multiple meanings such as *we, you, he, she, it, they, people*), and educational system with schools in particular. The percentage of appearances in relation to the total number of posts considering solutions in the three sectors is visualized in Figure 51.

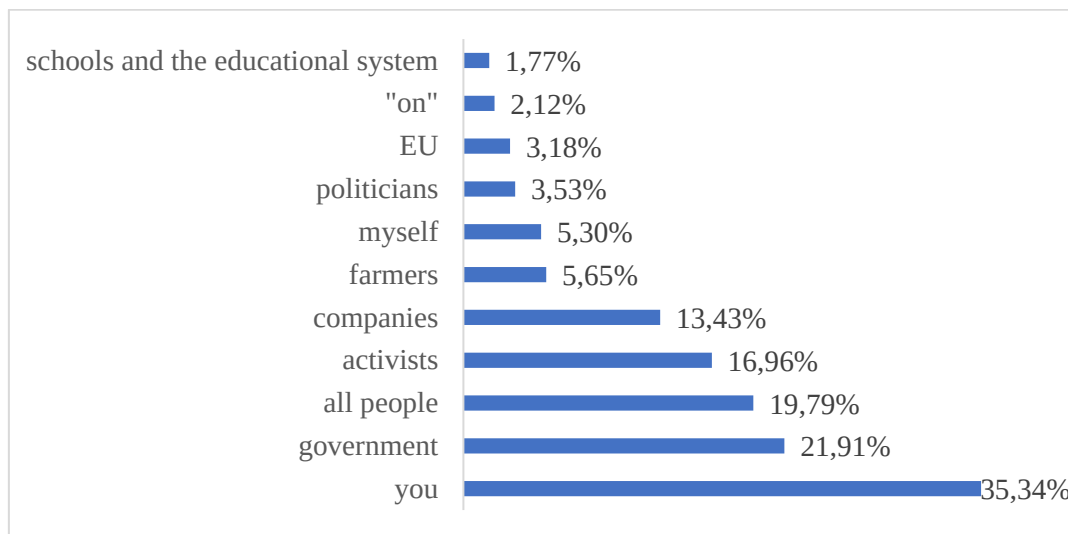


Figure 51 Actors responsible for CC mitigation mentioned in the posts by environmental OLOs in France, % of the total number of posts considering solutions in the food, energy, and transport sectors

The pronoun “on” appeared in two types of posts: 1) posts where it was possible to identify an actor behind “on” and 2) where the meaning behind “on” was ambiguous or unclear. An example of “on” meaning “all people” or “you” was provided in a post by @cestbonpourlaplanete on 19 September 2021:

“Comme d’habitude quand #CestBonPourLaPlanete et **qu’on fait des économies d’eau et d’énergie, on fait aussi des économies sur ses p’tits sous** - ici, c’est jusqu’à 160€ par an qu’on peut mettre dans son budget vacances”.

In another example from a post by @jeunesecologistes on 26.11.2021 (Figure 52), the organization wrote “[...] **on** revient sur toutes les mesures bradées pendant le quinquennat, [...] Il est temps d’arrêter de brader la planète ! En 2022 **on** sort du consumérisme ! [...]”. With a portrait of President Macron (who is clearly a “villain”), the mentioned promises of the Citizen

Convention, and the identified leader of the Green Party, Jannick Jadot, in the hashtag to the post, it is very complicated to identify the real actor behind this “on” in the last phrase of the message: “En 2022 **on** sort du consumerisme !”. This last “on” can be attributed 1) to the Green party and their leader, Jannick Jadot, who will help the transition, or 2) to President Macron, who should contribute to reducing overconsumption, or even 3) to all people who are demanded to act.



Figure 52 Post by @jeunesecologistes on 26.11.2021

6.2.2.3 Obstacles

In the majority of the posts about CC and environment-related topics, the environmental OLOs did not specifically discuss the obstacles to CC mitigation. In the remaining posts – 33,55%, or 105 out of 313 posts considering food, energy, and transport themes – we observed different barriers on individual or group levels. These barriers included *wrong political action, corporate misbehavior, organizing the action, personal feelings and emotions, money, communication issues, and actions of other laypeople*. The percentages of each category concerning the total

number of posts mentioning the obstacles (N=109) are demonstrated in Figure 53. In the following paragraphs, we describe each obstacle in detail.

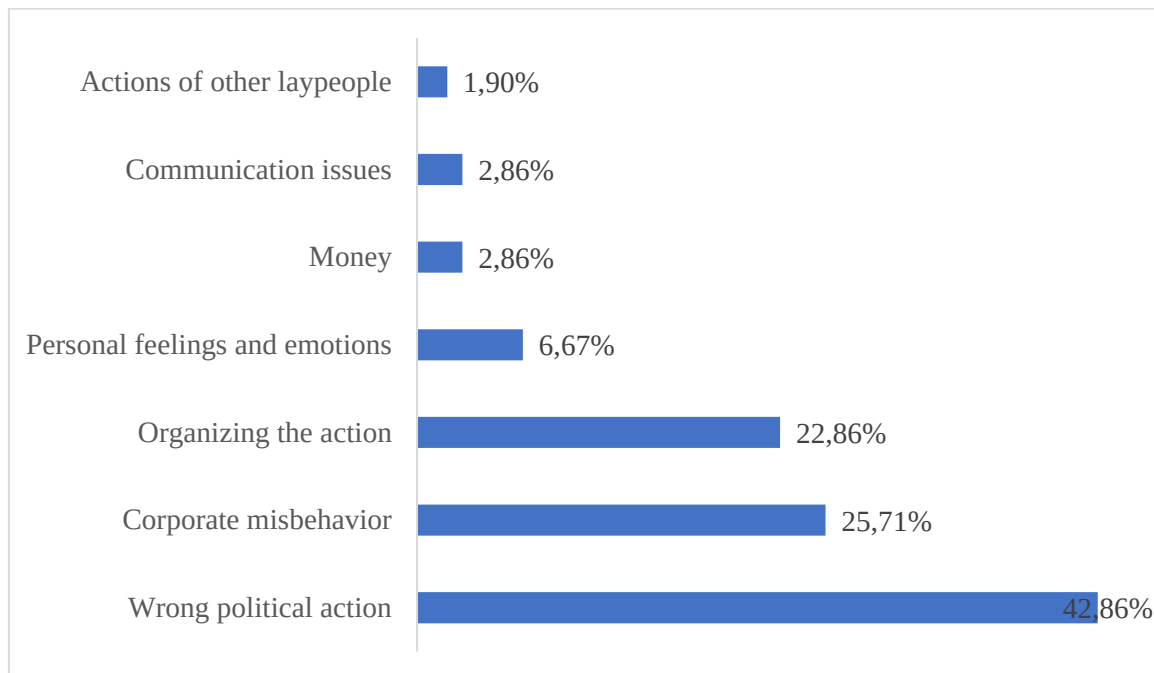


Figure 53 Distribution of obstacles in the posts by environmental OLOs in France, % of the total number of posts containing obstacles

In 45 of 313 posts considering sustainability transition in the food, energy, and transport sectors, environmental OLOs identified *wrong or insufficient political action* as the main obstacle to sustainability transition. For example, the government's legislative and financial support of fossil fuel and nuclear energies or inefficient policies were mentioned as the main obstructive factor to the transition.

Corporate misbehavior was attributed to the fossil fuel companies, airline companies, or agriculture industries mainly due to their promises, which were not achieved, or due to the greenwashing present in their communication, which can demotivate other people to act.

Organizing the action was a vast category of obstacles that incorporated the difficulty of making an effort to CC mitigation on an individual level, too slow or not adapted transition measures, low profitability for sustainable companies, and the controversial nature of proposed solutions. For example, in a post by @onespret on 17.02.2022, the organization wrote: “As-tu revu à la baisse ton usage de l’avion ces dernières années, **ou est-ce encore un choix trop difficile** et tu préfères agir ailleurs ?”. In this comment, the organization implicitly attributed

the obstacle to their audiences in the form of a question yet highlighting that a person could contribute to CC mitigation by other pro-environmental actions. In another example from a post by @reseauactionclimat on 18.01.2021, the organization provided a map of the project to cease ten airport extensions in France; however, only two airports are concerned by the law, yet with some exceptions (Figure 54).

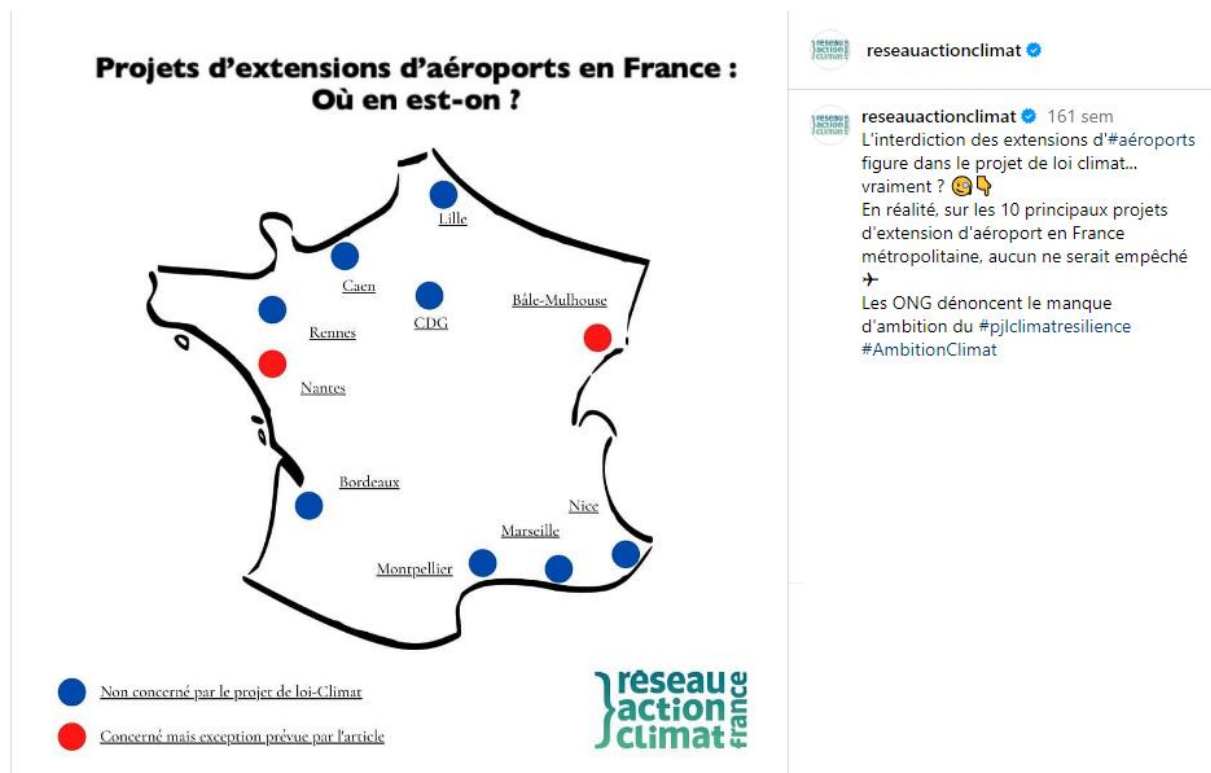


Figure 54 Post by @reseauactionclimat, 18.01.2021

The controversial nature of some solutions was underlined in the posts, considering the increase of meatless menus in school canteens and the need for renewable energy. @onestpret wrote on 20 April 2021:

“Instauration d’une option végétarienne quotidienne dans les self-services des cantines des primaires, collèges et lycées, **mais sur la base du volontariat**. Pas d’obligation donc ! 😊 C’est pourtant sur ce point précis que l’impact pouvait être important. Sachant que plus d’1 milliard de repas sont servis chaque année en restauration scolaire et que 12% des 15-25 ans se déclarent végétariens, ce qui est largement supérieur à la moyenne française. **Domage donc de ne pas pouvoir leur proposer une option végé convenable quotidiennement.**”

In this example, the authors emphasized that the initiative to propose vegetarian options in schools was welcomed; however, it was not adopted on a permanent level.

Personal feelings and emotions were less discussed in the posts by environmental OLOs in France, and they were always attributed to the post's readers and expressed in the form of questions. This category of obstacles can be described as having no energy to act, not being confident about the future, or feeling guilty for not contributing enough to CC mitigation.

The money category mainly reflected the development of new energy and transport infrastructures, which can be high-priced and, therefore, not always adapted.

Communication issues in the obstacles were mainly represented by the number of available resources, which sometimes contradicted each other and might confuse citizens, or the existence of information about different actions that had not been well developed and therefore not communicated to the citizens.

Actions of other people were mentioned the least frequently in the posts by the environmental OLOs and comprised mainly of the influence of other people as demotivating factors for other people's efforts. As other obstacles related to the barriers on the individual level, it was expressed in the form of a question, indirectly mentioning the obstacle.

It should be noted that some of the identified obstacles in the posts by environmental OLOs were attributed by the authors in relation to the possible obstacles for other people and entities, i.e., not the obstacles on their level. Besides, while the majority of the posts introduced different obstacles, almost all of the observed posts suggested further solutions that can be done to overcome this obstacle.

In 99 out of 313 posts concerning energy, food, and transport by environmental OLOs in France, we observed different entities criticized for their irresponsible behavior or position to pro-environmental actions. These criticized actors included companies, government, politicians, the EU, farmers, "on" (indefinite French pronoun), and all people (Figure 55).

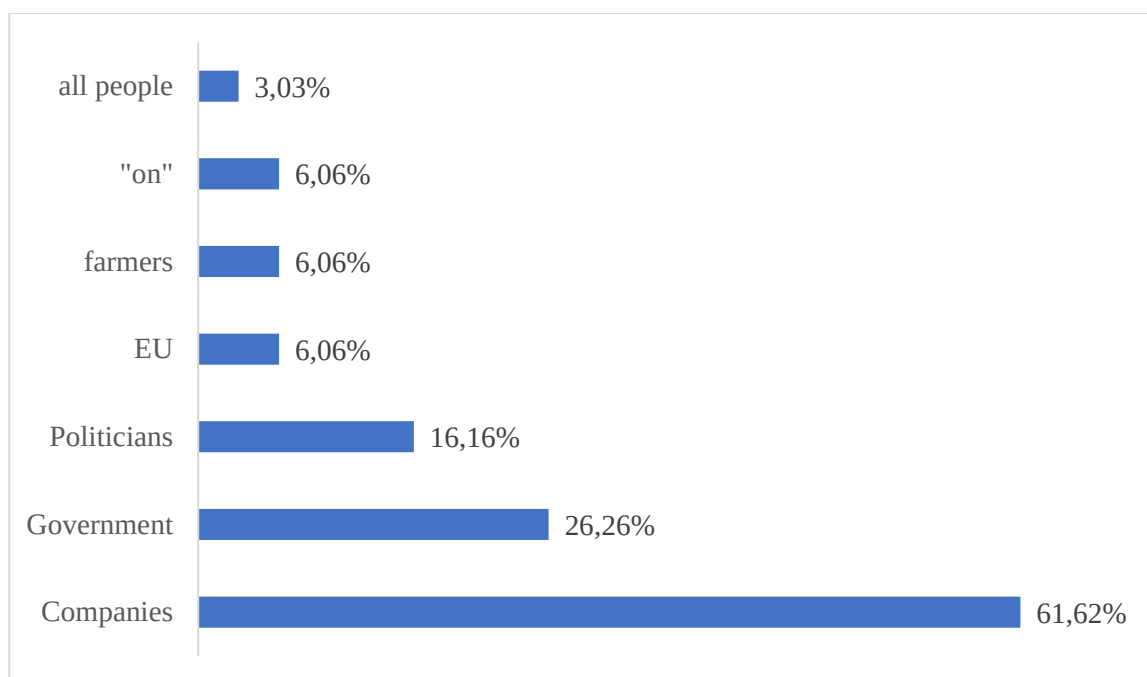


Figure 55 Distribution of criticized entities in the posts by environmental OLOs in France, % of the total number of posts identifying criticized figures

The companies that were more frequently attributed responsibility for inaction in the analyzed posts were *Total*, *Engie*, *Shell*, and *Volkswagen*. In Figure 55, we separated several political leaders from the government entity to demonstrate their high presence as criticized actors in the corpus. The most frequently criticized political leaders for irresponsible behavior toward sustainability transition were President Macron, Minister of Economics Bruno Le Maire, and Minister of the Interior Gérard Darmanin.

6.2.2.4 Values

The analysis of the posts has shown the vital role of the biospheric values in communication by environmental OLOs in France. Egoistic and altruistic values were almost equally represented in our data, while hedonic values were less discussed in the posts by organizations. Detailed statistics regarding the values that appeared in the posts by environmental OLOs in France are presented in Table 27. In the paragraphs below, we describe each value cluster.

Table 27 Observed values in the posts by environmental OLOs in France, % of the total number of posts regarding food, energy, and transport themes (N=313)

Value cluster	Value item	Number of posts in general (% of total)		Number of posts in relation to obstacle (% of total)	
Biospheric		236	75,40%	-	-
	Unity with nature	2	0,64%	-	-
	Respecting the Earth	1	0,32%	-	-
	Protecting the environment	148	47,28%	-	-
	Preventing pollution	108	34,50%	-	-
Altruistic		104	33,23%	-	-
	Health of all people	24	7,67%	-	-
	Helpful to others	40	12,78%	-	-
	World at peace	3	0,96%	-	-
	Social justice	44	14,06%	-	-
	Equality	-	-	-	-
Egoistic		114	36,42%	63	20,13%
	Successful	-	-	-	-
	Social recognition	-	-	-	-
	Personal health	3	0,96%	-	-
	Ambitious	14	4,47%	6	1,92%
	Wealth	52	16,61%	28	8,95%
	Influential	6	1,92%	3	0,96%
	Authority	33	10,54%	20	6,39%
	Social power	15	4,79%	11	3,51%
Hedonic		67	21,41%	16	5,11%
	Inner harmony	2	0,64%	-	-
	Satisfaction of accomplishment	11	3,51%	-	-
	Comfort	19	6,07%	11	3,51%
	Self-indulgent	-	-	-	-
	Enjoying life	29	9,27%	1	0,32%
	Pleasure	11	3,51%	5	1,60%

Biospheric values were predominantly expressed in the analyzed posts by environmental OLOs regarding sustainability transition in the food, energy, and transport sectors: 75% out of 313 posts. These values were represented by highlighting the necessity or importance of unity with nature, respecting the Earth, environmental protection, and preventing pollution. Preventing pollution value item was frequently represented in the images illustrating smog or emissions from fossil fuels. In the texts, the biospheric value item of preventing pollution was highlighted with the polluting actions from industries. Protecting the environment was introduced in both images and texts. The images represented it through pictures of nature or people caring for it. In the texts, it was frequently described by the urgency to act for climate and to protect our planet. For example, the post by @amisdelaterrefr on 7 March 2022 stated: “Leur travail alerte

sur l'urgence d'agir pour **préserv**er et **partager** cette ressource essentielle qu'est **la terre**.” Other biospheric value items were more frequently introduced in the captions of the posts. For instance, the unity with nature can be illustrated by a text of @cestbonpourlaplanete on 27 February 2022: “💚 Parce qu'on est conscientes que faire du bien à la nature, c'est se faire du bien à soi-même, parce qu'on sait qu'**on fait partie intrinsèque de la nature**.”

Egoistic values were observed in 114 posts (36,42%), representing the second most frequent value cluster. This category included the significance of wealth, authority, social power, ambitions, personal influence, and personal health. Interestingly, the importance of wealth in efforts to mitigate CC was framed differently in the analyzed posts. Some posts highlighted the importance of different actions because the action could contribute to money savings. Other posts mentioned the necessity of having more financial resources to contribute to climate action because this action can cost a lot of money. Egoistic values were mainly expressed in the posts' captions and less frequently expressed in the images, primarily by the pictures from political meanings highlighting the authorities' role in solving the climate crisis.

The altruistic value cluster (33,23%) involved the importance of social justice, being helpful to other people, the health of everyone, and peace in the world. It was frequently visualized in the images by portraying people helping each other, photos of indigenous people in some cases. However, in the most cases this value was identified in the texts of the posts with such phrases as “pour la justice sociale,” “construire des sociétés justes et solidaires,” “pour notre avenir,” “agir pour la santé des citoyen·nes.” Peace in the world was mentioned mainly in February–March 2022 in the posts considering the war in Ukraine.

Hedonic values were identified in 21,41% of the posts considering our focus themes. They assessed the importance of enjoying life, being in comfortable conditions, satisfaction of accomplishment, feeling of pleasure, and inner harmony. In the images, they were mainly represented by pictures of food. In the texts, they were highlighted by the importance of personal positive feelings and comforts. For example, @cestbonpourlaplanete posted regarding organizing home vegetable or fruit growing “🌱 Gagner en autonomie, **c'est tellement bon pour l'estime de soi et pour le moral !**”

As we may see from Table 27, the values concerning the identified obstacles in the posts are not numerous. However, we may see some connections between egoistic and hedonic values and the obstacles in the posts. The most frequently expressed egoistic value regarding the obstacle was wealth. *Wealth*, in this case, could have a twofold meaning: 1) a significant lack

of money to contribute to pro-environmental action was crucial in certain cases and influenced inaction, and 2) the desire to have more money, more frequently attributed to the fossil fuel companies or banks was an important factor for them not to reduce fossil fuel advertisement. *Authority* in relation to obstacles was attributed to the importance of positions of political actors for governmental decisions regarding sustainability transition, which in this case contradicted the SDGs. *Social power* concerned the importance of having control by companies and their leaders, who could use it to influence CC mitigation policies negatively. *Ambitions* were attributed to the lack of importance, desire for achievement, or unwillingness to work towards sustainability transition due to different reasons.

Most of the identified values were generally used in different combinations in the posts. For example, Figure 56 shows altruistic value in the image by a portrait of a young woman wearing a face mask because of air pollution. In the verbal mode, this value is highlighted in the text within the image and in the caption. A phrase from the post illustrates biospheric, altruistic, and egoistic values altogether:

“Alors que la réduction de la consommation d’engrais azotés et **un enjeu majeur pour le climat, pour les agriculteur·ices, pour la santé des populations, et pour l’environnement**, on comprend mieux pourquoi le @gouvernementfr fait tout pour enterrer la proposition des 150 membres de la @conv_citoyenne d’une redevance sur ces engrais #LoiClimat 😊.”

The government members in this example used their position in society to contribute to the activities of the *Groupe Roullier*, a polluting factory. Nevertheless, the company itself and the pesticide industry were “above the law,” i.e., they used their social status to continue polluting action, which did not contribute to CC mitigation.



Figure 56 Post by @amisdelaterrefr, 17.06.2021

Besides the provided example of the co-occurrence of multiple values within one post, we observed other combinations of values in our data considering environmental OLOs. Figure 57 illustrates these co-occurrence networks. It shows the connections between biospheric value items, such as preventing pollution or protecting the environment, and altruistic value items, such as being helpful to others, social justice, or the health of all people. The thickness of the lines correlates with the number of co-occurrences of the values. In general, Figure 57 demonstrates that it is probable to observe biospheric – altruistic values within one post, altruistic – hedonic, altruistic – egoistic, biospheric – hedonic, or biospheric – egoistic value combination within one post. Egoistic – hedonic is the least frequently identified combination of values within one post.

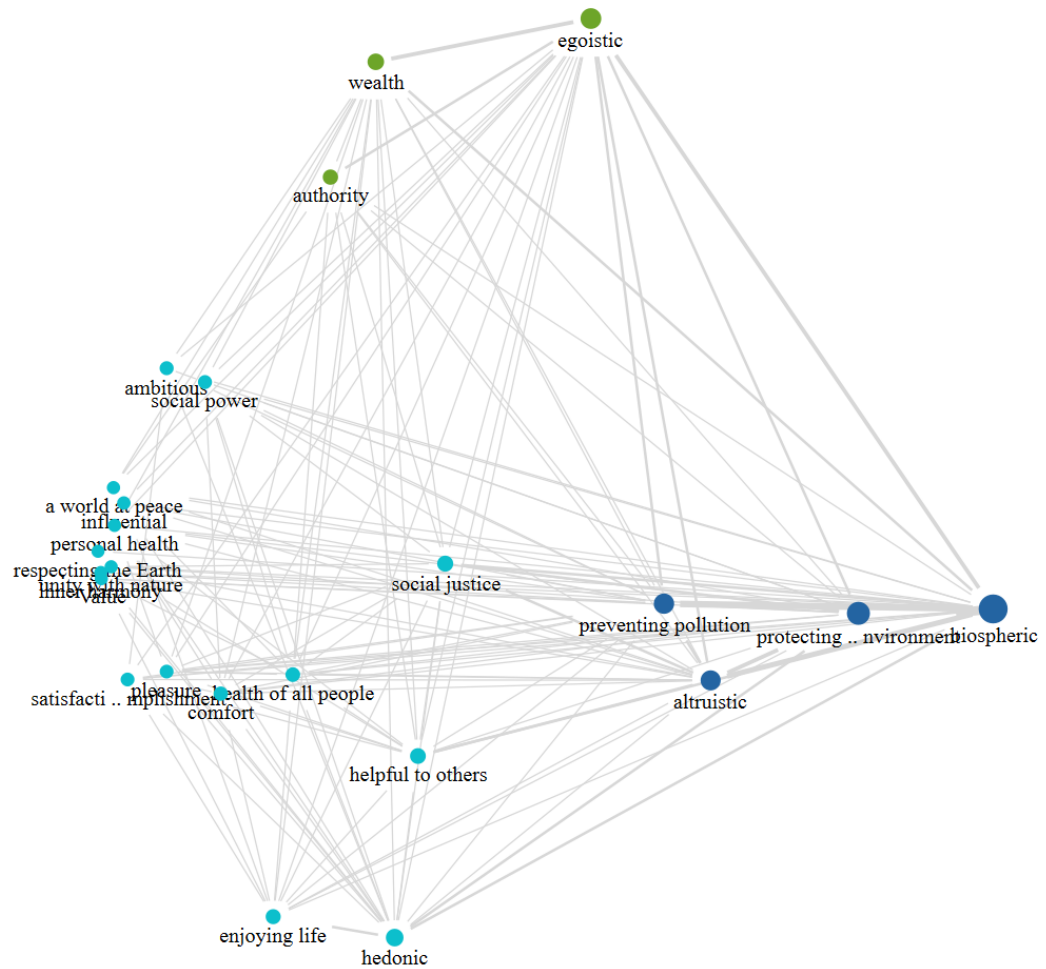


Figure 57 Co-appearing of values in the posts by environmental OLOs in France

In summary, the French environmental OLOs discussed predominantly the sustainability transition in the food sector in 2021–2022, yet the energy sector appeared in one-third of the posts. The most discussed solutions to CC mitigation considered improvements in the agriculture sector, consumption of organic and local products on an individual level, ceasing fossil fuel development and finance, and improving different transport infrastructures. The readers of the posts were identified as the significant actors contributing to CC mitigation, followed by governments, all people, activists, and companies. Critics and obstacles were not largely present in the posts. The most frequent obstacles mentioned were related to political actions, corporate misbehavior, and organizing the action. The biospheric values were present in the majority of the posts considering food, energy, and transport themes, often in combination with other values within the same post. The values concerning obstacles were related to the egoistic and hedonic value clusters and their specific items: wealth, authority, and social power.

France: Key findings

- Food was the most frequently discussed theme by the environmental OLs and OLOs.
- The most discussed solutions by the environmental OLs were the consumption of organic food, the development of renewable energies, and the improvement of public transport infrastructure.
- The most frequently discussed solutions by the environmental OLOs were the consumption of organic food, the cessation of fossil fuels, and the use of public transport infrastructure.
- The transport theme was the least communicated by the environmental OLs. However, politicians communicated about it more frequently than other individuals.
- The environmental OLs emphasized the role of individuals in contributing to CC mitigation. “Myself” and “you” (the audience) were most frequently mentioned as actors responsible for CC mitigation.
- The environmental OLOs emphasized the role of “you” (the posts’ readers) and the government as the main actors for CC mitigation.
- The pronoun “on” appeared in the organizational discourse in France concerning the actors responsible for CC mitigation and the actors criticized for their irresponsible position.
- The obstacles in the posts by environmental OLs included organizing the action, corporate misbehavior, wrong political action, communication and knowledge, personal feelings and emotions, social judgment, money, and stereotypes.
- The obstacles identified in the posts by environmental OLOs included wrong political action, corporate misbehavior, organizing the action, personal feelings, money, communication issues, and actions of other laypeople.
- The posts by OLOs mentioned more criticized actors for their inaction toward CC mitigation than the posts by OLs. The main criticized entities by the OLOs were companies, government, and politicians.
- Biospheric values were the most frequent in the posts by environmental OLs and OLOs.
- Egoistic and hedonic values were linked to the observed obstacles in the posts by environmental OLs and OLOs.
- In both subcorpora, the obstacles were more frequently mentioned in the posts’ texts or text-on-image elements, yet sometimes supported by the visuals.

6.3 Norway

In this part, we introduce the results from multimodal content analysis of the posts in *Corpus21-22_FET*. First, we demonstrate the results from the analysis of the posts by OLs in Norway (N=156). Second, we assess the results from the analysis of the posts by OLOs in Norway (N=108). Each part is structured according to the themes of the Codebook questions in the following order: CC themes, climate actions and actors, obstacles, and values. Due to the lack of data regarding the obstacles to pro-environmental action in the Norwegian subcorpus, this data is not qualitatively analyzed in Chapter 7. Thus, we complement our multimodal content analysis by providing prominent detailed examples in this chapter. The examples in the Norwegian language were translated into English with the online translator DeepL since the researcher does not speak it, and the original texts are provided in the footnotes. Some of the analyzed posts were in English; if so, the examples are presented in English and do not require an additional translation.

6.3.1 Instagram communication by environmental OLs about the sustainability transition in the food, energy, and transport sectors in Norway

6.3.1.1 CC themes

In 78,20 % of the examined data from the *Corpus21-22_FET*, Norwegian environmental OLs directly²⁶ (N=85) or indirectly²⁷ (N=37) addressed CC and environment-related topics. These themes were represented by food-related subjects in 67 posts (55% of the posts addressing CC issues), energy-related topics in 19 posts (16% of the posts addressing CC issues), and transportation-related issues in 31 posts (25% of the posts addressing CC issues). These themes appeared in the posts individually or in combination with each other. In total, 98 posts discussed at least one of our focus themes. Other themes unrelated to our primary topics of interest were predominant in the 21% of posts focusing on CC and the environment.

At this step, we also looked at the identified themes regarding the group of environmental OLs: political leaders and individuals pursuing creative professions. In the collected Norwegian data, the environmental OLs are represented by a relatively small number

²⁶ When CC or environment-related topics were explicitly mentioned in the posts

²⁷ When CC or environment-related topics were implicitly suggested in the posts

of individual enunciators. Although the Norwegian data is slightly underrepresented in *Corpus21-22_FET*, we noticed several differences in communication between politicians and individuals pursuing creative professions. In this data, politicians tended to mention the transport theme most frequently, while individuals in the creative profession group discussed food-related themes more frequently.

6.3.1.2 Climate actions and actors

After carefully observing the posts considering the food sector, we identified 59 out of 67 posts (88%) discussing solutions in this sector. Although the rest of the posts were somehow linked to the food theme, they did not propose any explicit or implicit action or solution towards sustainability transition in the food sector. **On an individual level**, the proposed solutions were following plant-centered diets, optimizing home cooking, different sustainable food practices, and sustainable meat and fish consumption. **Group actions** were less frequently discussed in the posts by environmental OLs in Norway, including supporting the agriculture sector, decreasing plastic packaging use, “fixing food,” and preventing food crises. The percentage for each action in relation to the total number of posts considering the food sector is demonstrated in Table 28. In the paragraphs below, we detail each proposed solution.

Table 28 Pro-environmental actions in the food sphere by environmental OLs in Norway

Action	Number of occurrences	% of analyzed posts about the food sector, OLs
Individual action		
plant-centered diet	24	40,68%
home cooking organization	13	22,03%
sustainable food practices	13	22,03%
sustainable meat and fish consumption	11	18,64%
Group action		
support of the agriculture sector	10	16,95%
decrease plastic packaging	6	10,17%
fixing food	4	6,78%
prevent food crisis	1	1,69%
Total posts about the food sector	59	

Regarding the *adaptation to plant-centered diets*, the OLs suggested “eating a 🌱-rich diet,” “a massive shift to more 🌱-rich diets,” “cooking with plants,” or consuming plant-based meat alternatives. According to a post by @radicalbroccoli on 17 May 2021, “Eating more plants is the single most effective thing we can do for our planet!”.

Home cooking organization as an effort to CC mitigation encompassed reducing food waste and organizing a home garden. The OLs provided personal examples for each effort, examples by other people, and asked their audiences about their experiences. For instance, @riiseanja wrote about her colleague's experience with food waste on 3 November 2021:

“For the past five years, **she has taught all ninth graders** in Asker **about food waste**. She has shown skeptical students and teachers that expired milk can taste just as good as before. She has shown that milk and other expired food can be used in cooking, or that brown bananas are great in smoothies. 📖 📱 🍌”²⁸

Sustainable food practices incorporated 1) following sustainable food diets, 2) consumption of seasonal fruits and vegetables, 3) consumption of organic products, 4) consumption of local products, 4) eating whole foods, and 5) eating healthy food. Since these practices appeared not frequently in our data, we united them under a global ‘sustainable food practices’ name. These actions were attributed to individual actions.

Sustainable meat and fish consumption in the observed posts included eating less meat, being selective on seafood, and eating less but better quality meat. For instance, @lindalike suggested on 22 June 2021: “So yes, **less meat is less heat**. But also, **a slice of local organic meat or wild salmon now and then, has less climate impact than water-intensive avocados, almonds and pistachios, flown from the other side of the world.**”

Fixing food was a term suggested in English by environmental OLs in the analyzed posts. It was mentioned as a vast solution in several posts, predominantly by @gunhild_stordalen, without specifying what it could be.

A combination of multiple actions in the food sector was observed in several posts. For example, @lindalike wrote on 18 January 2022:

“Better health and greener planet? The power is on our plates! And it starts at the grocery store. Challenge:

👉 Choose **plant based food** over meat and dairy

²⁸ Translated from Norwegian by DeepL. The original text is “De siste fem årene har hun undervist samtlige niendeklassinger i Asker om matsvinn. Hun har gitt skeptiske elever og lærere erfaring av at melk som har gått ut på dato kan smake like godt som før. Hun har vist at melk og annen utgått mat kan brukes i matlaging, eller at brune bananer er digg i smoothier. 📖 📱 🍌”

🌱 Choose fresh, **local** and **seasonal**

🌱 Choose **whole** over processed

🌱 Choose **natural** over artificial

🌱 Choose package free

🌱 Choose **no food waste** (be creative!)

Which of these choices are most challenging for you? And the easiest?



In this post, the author suggested at least seven sustainable food practices, including plant-based diets, consumption of local and seasonal products, prioritizing whole and natural products, and reducing packaging food waste.

The energy sector is the least frequently discussed theme by the environmental OLs in Norway, as shown in our data. The individuals principally discussed reducing fossil fuel production, particularly gas, oil, and coal, developing and supporting renewable energy projects, such as wind energy sources, and regulating energy policies. Regulation of the energy policies was connected to the COP26 meetings and regulation of the import of Russian gas. Although the numbers for each category are relatively small, we provided them in Table 29.

Table 29 Pro-environmental actions in the energy sphere by environmental OLs in Norway

Action	Number of occurrences	% of analyzed posts about the energy sector, OLs
Group action		
Decrease the development of fossil fuels	12	75,00%
Develop and support renewable energies	5	31,25%
Regulate energy policies	2	12,50%
Total posts about the energy sector	16	

In several posts, we observed discussions about fossil fuels and renewable energies within the same phrases. For example, Arild Hermstad, a politician for the Green party, wrote on 29 May 2021: “An oil commission must be established with the parties in working life with the aim of **starting the phasing out of the petroleum industry and the conversion to new, green**

industrial projects.”²⁹ In another example from 10 September 2021, @josephinegjerde suggested: “This is needed when the climate crisis is knocking on the door and the head of the UN is asking all countries **to stop exploring for more fossil fuels** and instead **focus on renewables.**”³⁰ In both phrases, the authors emphasized the necessity of reducing fossil fuel production and developing renewable energy sources. According to the enunciators, this action should be regulated at the government level. The pictures from these posts illustrated rather the authors of the posts than energy-related issues in particular.

In the transport sector, we identified 31 posts considering solutions at individual and group levels. At an individual level, they included more frequent bike riding, use of public transport, reducing air travel, more frequent walking, use of electric vehicles, and reducing individual car use. At a group level, we distinguished improvement of public infrastructure, road infrastructure and safety, development of sustainable transport, and regulation of transport policies. Table 30 illustrates the numbers of occurrences in the posts. In the paragraphs below, we recapitulate some of the most prominent actions.

Table 30 Pro-environmental actions in the transport sphere by environmental OLs in Norway

Action	Number of occurrences	% of analyzed posts about the transport sector, OLs
Individual action		
Ride bikes more often	9	29,03%
Use more often public transport	3	9,68%
Reduce air travels	3	9,68%
Walk more	3	9,68%
Use of electric vehicles	2	6,45%
Reduce individual car use	1	3,23%
Group action		
Improve public transport infrastructure	13	41,94%
Improve road infrastructures and safety	6	19,35%
Develop sustainable transport	4	12,90%
Regulate transport policies	1	3,23%
Total posts about the transport sector	31	

²⁹ Translated with DeepL from Norwegian. The original phrase “Det må opprettes en oljekommisjon med partene i arbeidslivet med mål om å starte utfasingen av petroleumsindustrien og omstillingen til nye, grønne industriprosjekter”.

³⁰ Translated with DeepL from Norwegian. The original phrase is “Det trengs når klimakrisen banker på døren og FN-sjefen ber alle land om å slutte å lete etter mer fossil energi og heller satse på fornybart”.

The riding a bike individual effort was more frequently represented in the posts' texts, use of emojis such as 🚲 or 🚴, or images illustrating personal examples of riding a bike by an individual. In the majority of the posts, individual efforts were directly expressed in the posts as personal examples, recommendations, or suggestions for other people. Yet, an indirect effort to the sustainability transition was mentioned in a post by @gunhild_stordaelen (Figure 58). In this post, the author provides an example of a 71-year-old lady who traveled by bike from Sweden to visit COP26 events. The author highlighted a particular example of individual efforts by another person demanding a collective action that should have been done at the COP26 meetings.



Figure 58 Post by @gunhild_stordaelen, 13.11.2021

The individual action of taking more public transport, such as trains, was frequently accompanied by the actions governments should take to improve public transport infrastructures, including railway transportation. Environmental OLs from this subcorpus recommended constructing new rails in Norway, developing new train lines connecting the country with the European continent, improving the Norwegian interrail system, providing more affordable train tickets, and proposing more train departures.

Improvement of road infrastructures implied providing secure space for bike riders and a decrease in new motorway projects. Improvement of public transportation and a decrease in new motorway projects were used in one post as opposite actions. On 10 September 2021, @lanmaries, a Parliament leader, wrote: “With us in government, we will **stop costly motorway projects** and **focus on trains**.”³¹ Indeed, this post was used during the parliamentary elections in Norway, and the action is attributed to a newly elected government in case they win this election.

The sustainable transport category of actions implied the development of low-carbon transport in general and the development of emission-free air transport in particular.

In the posts by the selected environmental OLs in Norway, the responsibility to act for the climate was attributed to different actors: all people, “you,” politicians, “myself,” government, industries, and companies. These actors are illustrated in Figure 59, where the percentage was calculated in relation to the total number of posts considering solutions in the food, energy, and transport sectors (N=98). The importance of individual efforts was highlighted by attributed roles to different individuals, such as everybody or all people, “you” – the readers, and “myself.” The role of politicians and governments was mentioned in multiple posts considering parliamentary election campaigns and promises by different parties and their leaders. The role of industries and companies in CC mitigation was less discussed in the analyzed posts. It was mainly attributed to grocery shops, the airplane industry, the seafood industry, and the food industry.

³¹ Translated from Norwegian with DeepL. The original phrase is “Med oss i regjering stopper vi svindyre motorveiprosjekter og satser på tog”.

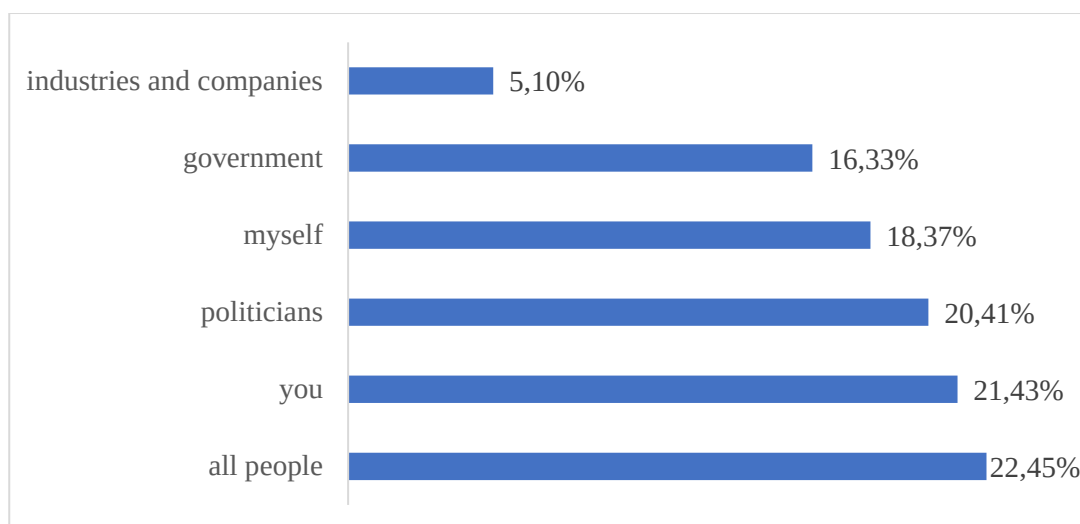


Figure 59 Actors responsible for CC mitigation mentioned in the posts by environmental OLs in Norway, % of the total number of posts considering solutions (N=98)

6.3.1.3 Obstacles

21 posts (24,43%) out of 98 considering food, energy, and transport spheres included obstacles to pro-environmental behavior. These obstacles were directly or indirectly introduced mainly in the texts of the posts. They included such categories as wrong political action, corporate misbehavior, money, time, social judgment, and misinformation.

Wrong or insufficient political action referred to the government's development of plans contradicting the established SDGs. Below, we provide three examples of this obstacle from the posts.

1. When we know all of this, WHY do governments not only let the food industry's sugar coated meat heavy home alone party go on, but continue to subsidise it? (from a post by @gunhild_stordalen, 16.10.2021)

2. **Politicians would rather rely on expensive, unknown technologies to be rolled out** on a MASSIVE scale to suck carbon out of the air and store it forever. (from a post by @riiseanja, 15.03.2021)

3. Instead, this government is focusing on insane highway projects that destroy nature and give the airline industry lots of advantages. Let's do what Europe does instead: invest in fast and modern trains! (from a post by @arildhermstad, 04.09.2021)

Example 1 indirectly evokes the obstacle in a question form, where the author wonders why the governments continue to financially support the meat industry when it has so many harmful effects on the environment. Example 2 suggests that politicians working on sustainability

transition propose solutions that demand considerable financial resources and rely on unknown technologies. Example 3 highlights the government's focus on projects that do not contribute to solving the climate crisis but negatively influence nature.

Corporate misbehavior referred mainly to companies' or organizations' investments in wrong or controversial solutions, which can be related to environmentally harmful activities. For instance, @arildhermstad discussed the negative influence of a communication report by the Norwegian Oil and Gas organization claiming that reductions in Norwegian oil production will not result in a global increase in greenhouse gas emissions. The author wrote on 31 August 2021:

“In a desperate attempt to influence the election campaign, the country's most powerful lobbying organization, Norwegian Oil and Gas, has today released a “report” showing that **cuts in Norwegian oil production will not lead to global greenhouse gas emissions**. This commissioned work is part of the propaganda that the oil industry is mobilizing in response to the UN's devastating climate report, which was published on 9 August this year”³².

The obstacles related to *money* highlighted the necessity of having much money to contribute to pro-environmental action. It was implicitly evoked in one post and combined with *time* obstacle. @gunhild_stordaelen posted: “To take the train, you need to be a @gretathunberg **idealist with lots of money** and **PLENTY of time**. It cant be this way if we are to tackle climate change! 🤔🌍” on 11 November 2021. In this post (Figure 60), the author provided a personal example of taking multiple trains to attend the COP meetings. In a video to this post, the author described a personal experience of long-distance travel by train and said: “ [...] I am very close to being **seriously fed up. This train is now delayed**, at least 45 min [...] The train actually left the station before I got out...”. Although the author did not directly associate these phrases with the obstacles, she emphasized that “**it is not easy!**” in the video to the post. Besides discussing the challenges in adapting personal transportation, the author attributed the

³² Translated from Norwegian with DeepL. The original phrase is “I et desperat forsøk på å påvirke valgkampen har landets mektigste lobbyorganisasjon Norsk Olje og Gass i dag sluppet en “rapport” som skal vise at kutt i norsk oljeproduksjon ikke vil føre til globale klimagassutslipp. Dette bestillingsverket er en del av propagandaen som oljebransjen mobiliserer i møtet med FNs knusende klimarapport, som kom 9. august i år.”

significant responsibility to act to the governments that should “invest in low carbon transport systems” (Figure 60).

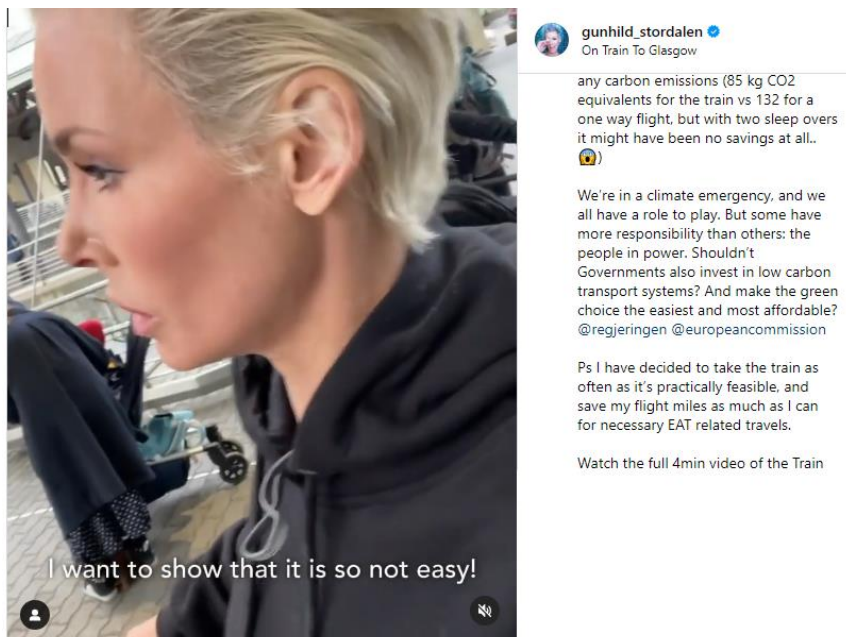


Figure 60 Post by @gunhild_stordaelen, 11.11.2021

Social judgment, or judging other people’s efforts for not being perfect, was attributed in one post as an obstacle that can discourage the sustainable efforts of other people, not the author herself. In this example, @greenbonanza wrote on 13 December 2021:

“The eternal discussions about E120, Queen’s chocolate and wool socks are petty things we should be able to put aside, and instead cheer on the fact that many people are achieving something, rather than a small clique being “immaculate” based on a definition of an ism. **I sincerely believe that those who promote perfectionism and at the same time criticize those who do not, are doing something dangerous when they contribute to discouraging many.**”³³

³³ Translated from Norwegian by DeepL. The original text is “De evige diskusjonene om E120, Dronningsjokolade og ullsokker er småtterier vi burde kunne legge fra oss, og heller heie på at mange får til noe, fremfor at en liten klikk er «plettfrie» basert på en definisjon av en isme. Jeg mener oppriktig at de som fronter perfektjonismen i det, og samtidig kritiserer de som ikke gjør det, gjør noe farlig når de bidrar til å gjøre mange motløse.”

Misinformation as an indirect obstacle was mentioned in one post criticizing the Seaspiracy film director for providing wrong information in the movie, which can “enhance the already divisive and polarized culture we have” (from a post by @gunhild_stordalen, 5 April 2021).

The actors responsible for their lack of contribution to the sustainability transition included predominantly different group actors. However, they were not often mentioned in the posts by environmental OLs: only 17 out of 98 analyzed posts about the sustainability transition in the food, energy, and transport sectors. Among these actors, the OLs mentioned government (N=7), politicians (N=3), companies (N=3) such as different oil lobbies (*Oljelobbyen*) and *Norsk Olje og Gass* in particular, the agriculture sector (N=2), and everybody or all people (N=1).

6.3.1.4 Values

In Norway, the environmental OLs predominantly mentioned *biospheric values* in the analyzed posts considering the food, energy, and transport sectors. This value was identified in 61,22% of the posts (Table 31). The environmental OLs generally mentioned the importance of environmental protection and preventing pollution in their texts, emphasizing the importance of “the health of our 🌍” and “least impact on our climate 🌡️🌱” (from posts by @gunhild_stordaelen). Besides the text itself, the emojis of ❤️, 🌿, 🌱, or 🌍 were frequently used in the texts mentioning the biospheric value. In the images, the biospheric value was not frequently visualized. Indeed, the OLs showed pictures of emissions from fossil fuel power plants, green sprouts, parks, green trees, and animals, such as horses, in several pictures only.

Table 31 Observed values in the posts by environmental OLs in Norway, % of the total number of posts regarding food, energy, and transport themes (N=98)

Value cluster	Value item	Number of posts in general (in %)		Number of posts concerning obstacle (in %)	
Biospheric		60	61,22%	-	-
	Unity with nature	-	-	-	-
	Respecting the Earth	-	-	-	-
	Protecting the environment	42	42,86%	-	-
	Preventing pollution	19	19,39%	-	-
Altruistic		37	37,76%	-	-
	Health of all people	11	11,22%	-	-
	Helpful to others	15	15,31%	-	-
	World at peace	2	2,04%	-	-
	Social justice	12	12,24%	-	-
	Equality	-	-	-	-
Egoistic		41	41,84%	19	19,39%
	Successful	-	-	-	-
	Social recognition	1	1,02%	1	1,02%
	Personal health	2	2,04%	-	-
	Ambitious	-	-	-	-
	Wealth	12	12,24%	7	7,14%
	Influential	-	-	-	-
	Authority	22	22,45%	7	7,14%
	Social power	9	9,18%	5	5,10%
Hedonic		34	34,69%	2	2,04%
	Inner harmony	-	-	-	-
	Satisfaction of accomplishment	8	8,16%	-	-
	Comfort	2	2,04%	2	2,04%
	Self-indulgent	-	-	-	-
	Enjoying life	21	21,43%	-	-
	Pleasure	4	4,08%	-	-

Egoistic values were observed in 41 posts (41,84%, cf. Table 31), representing the second most frequent value cluster. This category included the importance of authority, wealth, social power, personal health, and social recognition. By the authority in the posts, we understood the recognition of other people's authority and the importance of having power or control over decisions. For example, @gunhild_stordalen posted on 6 November 2021:

“Deeply moved by my meeting with **Pope Francis** at the Vatican last Wednesday. His **strong message to people in power** and to all of us to **ACT NOW to restore our one and only home** and **to do so with JUSTICE for the most vulnerable**, is exactly what our world needs.”

This message highlighted the recognition of the authority of Pope Francis. In addition, the author mentioned the importance of nature restoration (biospheric value) and social justice (altruistic value). Authority, i.e., recognition of power and desire to lead, was frequently attributed to posts about sustainability transition themes in the parliamentary election campaign. @lanmaries wrote on 10 September 2021: “**With us in government, we will stop** expensive highway projects and **focus on** trains.”. The author emphasized the importance of being in power or having authority for his political party, which is needed to contribute to the sustainability transition in the transport sector.

Egoistic value item *wealth* in the analyzed posts was frequently attributed to the posts mentioning money as an essential factor to contribute or not to climate efforts in the three sectors. In most cases, the author attributed the necessity of having more money to other people. @gunhild_stordalen wrote on 16 October 2021: “Today, **you need to be WEALTHY** to be HEALTHY (and sustainable)👉👉.” In another example, the author accentuated the high prices of railway transport, which can be difficult to afford for some people; however, the author proposed a solution to this problem afterward. This scheme – identifying the problem and proposing solutions – is central in the communication of politicians from the Norwegian corpus since they promoted their parties for the parliamentary elections in Norway. As such, @arildhermstad wrote on 20 May 2021:

“😁 But **trains are expensive for many young people today**, and the regular interrail tickets are not valid within their own country. That’s why we want to introduce Norwegian interrail tickets! We want to give you the opportunity to travel emission-free and cheaply around Norway.”³⁴

Among the posts containing the *altruistic value cluster* (present in 37,76% of analyzed posts), the environmental OLs claimed the necessity of being helpful to other people, social justice, remaining in good health for everyone, equality, and the world at peace. *Hedonic values*, specifically the importance of enjoying life, satisfaction from an accomplished task, pleasure, and comfort, appeared in 34 Instagram posts, equivalent to 34,69% of the posts considering

³⁴ Translated from Norwegian with Deepl. The original text is “😁 Men tog er dyrt for mange unge i dag, og de vanlige interrailbilletene gjelder ikke innenfor eget land. Derfor vil vi innføre norske interrailbilletter! Vi vil gi deg muligheten til å reise utslippsfritt og billig rundt i Norge”.

food, energy, and transport themes. Detailed statistics concerning the values that appeared in the posts by environmental OLs are explained in Table 31.

In the analyzed data, we observed a tendency for the co-occurring of different values within the same post and will provide several examples. In a post by @gunhild_stordalen on 23 September 2021, the OL wrote: “To us at EAT, it’s about food that is **good for our health, for climate and the environment, for the farmers and food producers, and for the animals** ❤️🌍👨🌾🐮🐷.” In this post (Figure 61), three values are combined: altruistic, biospheric, and hedonic values. Altruistic and biospheric values were expressed in the text mainly by highlighting the importance of caring for other people and the environment and by using thematic emojis of the planet, farmer, and animals relative to the message. The hedonic value item of enjoying life, i.e., the desire to have fun, was mentioned in the text of the post and the photo of happy group members (Figure 61).



Figure 61 post by @gunhild_stordalen, 23.09.2021

Another example by the same enunciator demonstrated a combination of egoistic, altruistic, and biospheric values. The text from the post in Figure 62 emphasized the powerful role of

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ambitious politicians in addressing sustainable development in the food sector (egoistic value). This is to guarantee the support of Norwegian farmers (altruistic value), to “promote health for all” (altruistic value), and to guarantee “welfare for the animals” (biospheric value). While altruistic and egoistic values from this post were represented in the text, the biospheric value of taking care of nature or protecting the environment was visualized in the photo of the post (Figure 62).



Figure 62 Post by @gunhild_stordalen, 6.03.2021

The values in relation to the obstacle to CC mitigation on individual and group levels were identified in 21 posts by the environmental OLs in Norway. In most cases, they were implicitly introduced in the posts. The last two columns of Table 31 provide the occurrences of values regarding the obstacles to pro-environmental behavior. Table 31 demonstrates that biospheric and altruistic values in this subcorpus were not connected to the obstacles to pro-environmental efforts in the food, energy, and transport sectors. *Egoistic* and *hedonic* value clusters and their items were generally implicitly related to the obstacles in several posts.

Egoistic values concerning obstacles appeared in 19% of the posts, and hedonic values in 2% of the analyzed data. The most frequent value items concerning obstacles were authority,

wealth, social power, and social recognition. *Authority* meant the importance of their position within society by political actors, which is in some cases used in contradiction to SDGs. *Wealth* signified 1) the importance of money, which was generally not sufficient for certain individuals, to contribute to climate action, or 2) the profits that are obtained by conducting environmentally unfriendly practices. *Social power* concerned the importance of having control by companies and their leaders, who could use it to influence CC mitigation policies negatively.

Authority was implicitly mentioned in the text to a post by @riiseanja on 09.08.2021: “Yesterday was the last day politicians could say “it’s important to cut greenhouse gas emissions, but...”, and **then excuse that they just don’t want to pay attention to the climate right now.**”³⁵ With this text, the author highlighted the power or authority of political leaders, who, unfortunately, may use their position to influence the sustainability transition negatively.

In a previously discussed extract from a post by @arildhermstad on 4 September 2021, we discussed the government being criticized for its irresponsible position. In the same example, the authority value item considering wealth can be identified. In this case, the government uses its position in society to invest in solutions harmful to nature: “Instead, **this government is investing in insane highway projects that destroy nature** and give the airline industry lots of advantages.”³⁶ @gunhild_stordalen also emphasized the role of “wrong” investments in climate crisis regulation considering the food sector: “Also, fixing food requires fixing FOOD FINANCE. Today, **money are flowing in all the wrong directions.** To things that are killing us, and our planet” (posted on 13.11.2021).

The hedonic value cluster was mainly represented by an essential role of comfort. The individuals highlighted that uncomfortable conditions of doing the action could demotivate them or other individuals to continue efforts to CC mitigation. As we saw from a post by @gunhild_stordalen (Figure 60), the need to pay much for travel by train and the amount of time spent on travel can discourage pro-environmental efforts. These obstacles can be related to the egoistic value of wealth and the hedonic value of comfort. Indeed, later in the text to this

³⁵ Translated from Norwegian with DeepL. The original text is “I går var den siste dagen politikere kunne si «det er viktig å kutte klimagassutslipp, men...», for så å unnskyldte at de ikke vil ta hensyn til klimaet akkurat nå, bare.”

³⁶ Translated from Norwegian with DeepL. The original phrase is “Denne regjeringen satser i stedet på vanvittige motorveiprosjekter som raserer naturen og gir flynæringen masse fordeler”.

post, the author provided a list of disadvantages that could discourage some people from taking trains for long-distance trips. This list included:

“☒ **12 times the flight time** (3 full days of travel, in total 28 hrs on 8 different trains)

☒ **5 times the price** (More than 12,000 NOK (~USD 1,400))

☒ **Plus 4-5 hrs** Booking the trip - via 5 different websites

☒ In addition to lots of hassle, little sleep, poor food and bad wifi.

And for what?

According to climate scientist Borgar Aalmaas at CICERO who kindly helped me calculate the climate footprint using klimatsmartsemester.se, I hardly saved any carbon emissions (85 kg CO₂ equivalents for the train vs 132 for a one way flight, but with two sleep overs it might have been no savings at all.. 🤔).”

The price of the journey (egoistic value-wealth), the time spent on organization, and the inconvenient conditions such as “poor food” or “bad wifi” (hedonic value-comfort) could be discouraging, in particular when a person “hardly saved any carbon emissions.”

In general, we noticed different combinations of environmental values within the same post and illustrated these co-occurrences in Figure 63. This graph demonstrates the proximity between biospheric, altruistic, and egoistic value clusters in the analyzed data. In other words, these values were more frequently combined within one post. Simultaneously, hedonic values were combined with altruistic (helpful to others) and egoistic (wealth) value items.

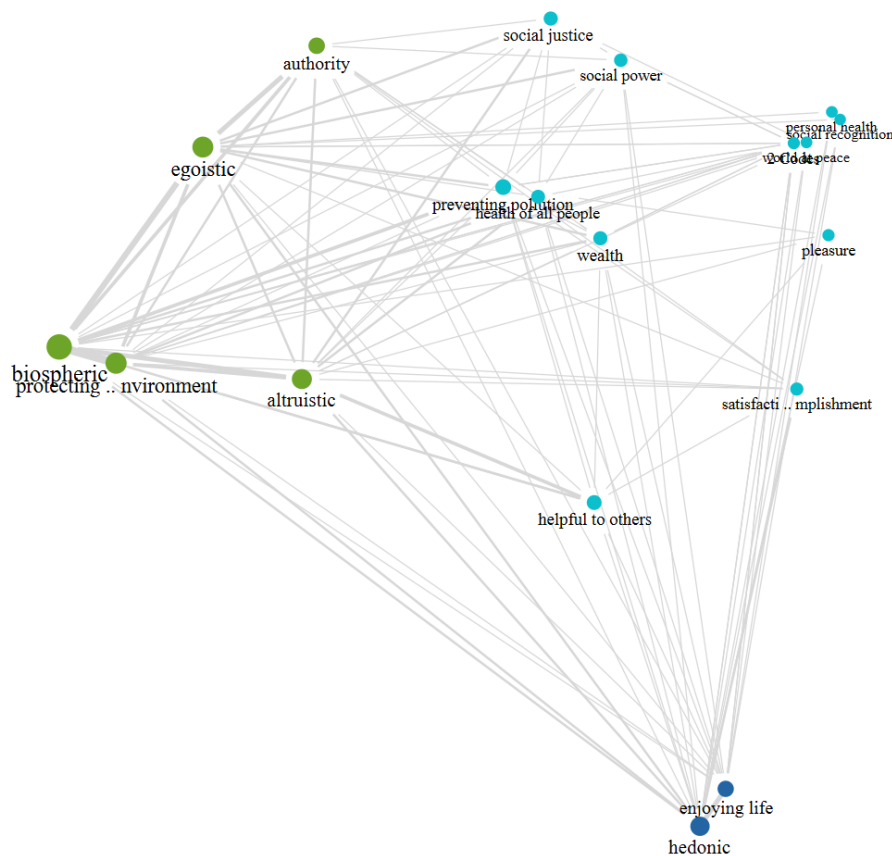


Figure 63 Co-occurrence network of values in the posts by environmental OLs in Norway

To summarize, the environmental OLs in Norway were represented by politicians and people of creative professions. People within the creative professions group tended to discuss food-related themes, while politicians discussed transport-related issues. The proposed pro-environmental efforts for sustainability transition included following plant-centered diets, ceasing the development of fossil fuels, and improving public transport infrastructures. According to the environmental OLs, the main actors that should contribute to CC mitigation were all people and politicians. Not many obstacles were observed in the analyzed posts. Among the most frequently mentioned obstacles, we identified wrong political action and corporate misbehavior. Indeed, governments, politicians, and companies, in particular the fossil fuel industry, were blamed for their irresponsible position towards the climate crisis and mitigation of its effects. The biospheric values were more often observed in the posts. In most cases, they were used in combination with other values within the same post. Although not numerous, the values concerning obstacles were related to the egoistic and hedonic value clusters and their items.

6.3.2 Instagram communication by environmental OLOs about the sustainability transition in the food, energy, and transport sectors in Norway

6.3.2.1 CC themes

In Norway, the environmental OLOs discussed either directly³⁷ (N=62) or indirectly³⁸ (N=25) topics concerning CC issues, corresponding to 80,55% of the posts by Norwegian OLOs from the *Corpus21-22_FET*. They mentioned food-related themes in 31 posts (41,38% of posts considering CC issues). The OLOs considered energy-related themes in 34% of posts considering CC issues. Issues related to transportation were mentioned in 6 posts, i.e., 6,9% of posts considering CC issues in this subcorpus. Among 36% of posts concerning CC and environmental topics in *Corpus21-22_FET*, other themes unrelated to our target subjects were also identified. Overall, since some posts combined two or three themes within them, the number of posts considering food, energy, and transport themes was 68.

6.3.2.2 Climate actions and actors

In 90% of the posts considering the food theme (28 out of 31), we identified the posts discussing solutions to CC mitigation in this sector. Although the rest of the posts were somehow linked to the food theme, they did not propose any explicit or implicit action or solution towards sustainability transition in the food sector. **At an individual level**, the proposed solutions were decreasing food waste, following plant-centered diets, adapting different sustainable food practices, and reducing meat consumption. **Group actions** were discussed in a few posts by environmental OLOs in Norway. They included the following actions: agriculture sector support, fishing industry regulation, and decreasing meat advertising. The percentage for each action in relation to the total number of posts considering the food sector is demonstrated in Table 32. In the paragraphs below, we detail each proposed solution.

³⁷ When CC or environment-related topics were explicitly mentioned in the posts

³⁸ When CC or environment-related topics were implicitly suggested in the posts

Table 32 Pro-environmental actions in the food sphere by environmental OLOs in Norway

Action	Number of occurrences	% of analyzed posts about the food sector, OLOs
Individual action		
decrease food waste	13	46,43%
follow plant-centered diet	5	17,86%
adopt sustainable food practices	5	17,86%
reduce meat consumption	3	10,71%
Group action		
support of the agriculture sector	2	7,14%
regulate fishing industry	2	7,14%
decrease meat advertising	1	3,57%
Total posts about the food sector	28	

Decreasing food waste was a largely discussed theme by the selected organizations in Norway. It comprised different concrete actions, such as regulating fridge temperatures to guarantee better storage of the food (example 1 below), making shopping lists before grocery shopping to buy only necessary food products (example 2 below), planning weekly menus in advance, or cooking with leftover products (example 2 below). Most of the provided recommendations were suggested by the account @mattvett.no, which is an organization for preventing food waste in Norway. In the examples below, we illustrate the abovementioned solutions.

1. “[...] A 2020 survey shows that 8 out of 10 Norwegian fridges have a temperature above the recommended 4°C. Not sure what the temperature in your fridge is? **Leave a thermometer in the fridge for a day and you’ll quickly find out!** 📏 Have you ever forgotten the milk on the kitchen counter? 🥛 Many of the foods we keep in the fridge stay fresh much longer if the temperature is at a maximum of 4°C. If it gets warmer, they go bad faster and we end up throwing food away because we didn’t have time to finish it 💔”³⁹

³⁹ Translated from Norwegian with DeepL. The original text is “[...] En undersøkelse fra 2020 viser at 8 av 10 norske kjøleskap har en temperatur over det anbefalte på 4°C. Ble du usikker på hva temperaturen i kjøleskapet ditt er? Legg et termometer i kjøleskapet en dag, så finner du raskt ut av det! 📏 Har du glemt melken på kjøkkenbenken noen gang? 🥛 Mange av matvarene vi har i kjøleskapet holder seg ferske mye lenger hvis temperaturen er på maks 4°C. Blir det varmere, blir de raskere dårlige og da ender det fort med at vi kaster mat fordi vi ikke rakk å spise den opp. 💔”

2. “27% of us say that the main reason they throw away food is because they have forgotten it in the fridge or somewhere else 😊 And yes, **we should write shopping lists and plan our weekly menu**, but no one is perfect! So what else can we do to avoid buying lots of food “just in case” that ends up in the trash in the next round? 🤔 [...]”⁴⁰

Several organizations promoted *plant-centered diets*. They typically provided plant-based recipes, as in the post by @klimaforskerne on 11.05.2021. In Figure 64, we see a portrait of Kristin, the director of the organization, providing a personal example of cooking vegan recipes, which is mentioned in the text “Here’s Kristin, our boss, with **her favorite vegan recipe: Mushroom roast!**”⁴¹. However, to provide more precise solutions to the sustainability transition in the food sector, the organization suggested following a link on their profile: “How can we **make agriculture as climate-friendly as possible** and eat food with the least possible emissions? Link to cases in bio 🌱🌿.”⁴² In this phrase climate-friendly agriculture is rather directed to a group action in the food sector. Besides plant-based recipes, Greenpeace Norway organized a 22-day vegan food challenge (“22 dager med vegansk mat 🥕🍎🍰”).

⁴⁰ Translated from Norweegian with DeepL. The original text is “27 % av oss oppgir at den viktigste grunnen til at de kaster mat er at de har glemt den i kjøleskapet eller et annet sted 😊 Og joda, vi burde skrive handlelister og planlegge ukesmenyen, men ingen er perfekte! Så hva annet kan vi gjøre for å unngå at vi handler inn masse mat «for sikkerhets skyld» som i neste runde havner i søpla? 🤔”

⁴¹ Translated from Norwegian with DeepL. The original text is “Her er Kristin, sjefen vår, med sin veganske favorittoppskrift: Soppstek!”

⁴² Translated from Norwegian with DeepL. The original text is “Hvordan skal vi drive mest mulig klimavennlig landbruk og spise mat med minst mulig utslipp? Link til saker i bio 🌱🌿”



Figure 64 Post by @klimaforskerne, 11.05.2021

The category of action considering *sustainable food practices* included 1) reducing dairy consumption, 2) promoting cultivated meat (“kultivert kjøtt” or “kunstig kjøtt”), and 3) reducing seafood consumption. Cultivated meat was indirectly promoted in one post by Greenpeace, where the organization emphasized the opportunities for cultivated meat that may attract people, such as “The opportunity to do something about world hunger, a smaller climate footprint, and possibly a lower price.”⁴³ The organization motivated a discussion on this theme in the comments to the post with a question appearing in the image “Vil du spise kunstig kjøtt?” which means “Do you want to eat artificial meat?” (Figure 65).

⁴³ Translated from Norwegian with DeepL. The original text is “Mulighetene for å gjøre noe med sult i verden, mindre klimaavtrykk, og eventuelt lavere pris.”



Figure 65 Post by @greenpeacenorge, 04.07.2021

Reducing meat consumption was mainly promoted in the posts by Greenpeace, which wrote: “The UN and several independent researchers have long since concluded that the production of animal-based food is one of the leading causes of climate change and environmental problems. Therefore, **consumption must be reduced**, both **in Norway and in the rest of the world**”.⁴⁴ With this text, the organization drew the readers’ attention to individual action of reducing meat consumption locally and globally. This action is founded on the results of the studies by the UN and several independent researchers.

At a group level, the organizations suggested supporting the agriculture sector by developing climate-friendly agriculture and providing a secure future for Norwegian farmers. As @greenpeacenorge wrote: “Instead of fighting for lower gasoline and diesel prices, **we demand ambitious climate proposals that secure the future of Norwegian farmers.**”

⁴⁴ Translated from Norwegian with DeepL. The original text is “FN og flere uavhengige forskere har for lengst konkludert med at produksjonen av animalsk mat er en av de ledende årsakene til klimaendringer og miljøproblemer. Derfor må forbruket ned, både i Norge og i resten av verden”.

Regulation of the fishing industry in the analyzed posts implied ceasing overfishing practices.

The #MeatTheLies Greenpeace campaign suggested reducing or even banning meat advertising. In a post with the #MeatTheLies hashtag, the organization highlighted the myths used in the communication of the meat industry to promote meat consumption, such as red meat as a symbol of masculinity (point 2 in Figure 66), eating meat as a part of national identity (point 5 in Figure 66), or eating meat is about freedom (point 7 in Figure 66). Although the organization did not explicitly specify the action in this post, this campaign's main idea was to reduce or ban meat advertisements.

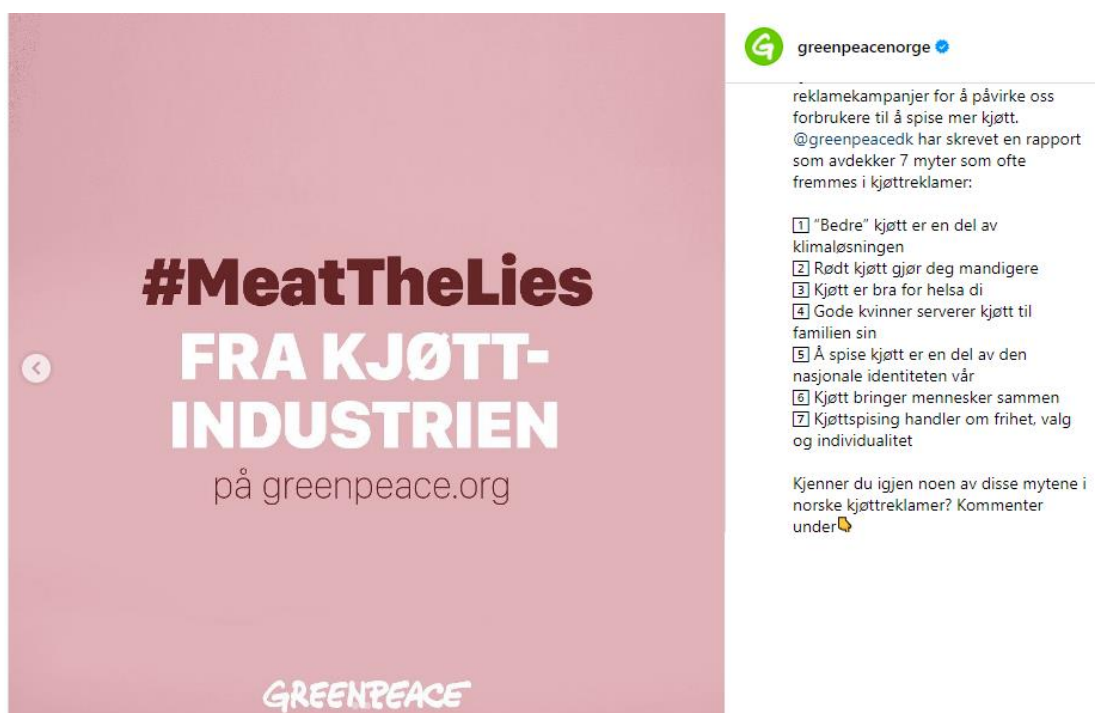


Figure 66 Post by @greenpeacenorge, 02.12.2021

In the energy sector, 25 out of 31 posts about the energy transition suggested different solutions at a group level, including decreasing fossil fuel production and development, developing renewable energies, ceasing the import of fossil fuels from Russia, and regulating energy policies. The exact numbers of appearances of each solution in the posts are illustrated in Table 33.

Table 33 Pro-environmental actions in the energy sphere by environmental OLOs in Norway

Action	Number of occurrences	% of analyzed posts about the energy sector, OLOs
Group action		
Decrease the development of fossil fuels	19	76,00%
Develop and support renewable energies	5	20,00%
Stop importing fossil fuels from Russia	3	12,00%
Regulate energy policies	1	4,00%
Total posts about the energy sector	25	

The reduction of fossil fuels was a major topic of discussion by different organizations. For example, @xrnorway explicitly demanded “a rapid phase-out of production on the Norwegian continental shelf - and an immediate halt to exploration”⁴⁵ of fossil fuels, such as oil and gas. In another example by @klimastiftelsen, the action was indirectly evoked in the post: “We’ve cleaned out our warehouse and found some copies of the book “**Europe without gas**” written by @tordhustveit. We published this together with Frekk forlag a few years ago. **Still relevant**”.⁴⁶

In several posts, we observed an opposition of two notions: fossil fuels and renewable energies. For example, @greenpeacenorge posted: “Our globe looks very different when it is supplied **with renewable energy** and **not polluting fossil fuels**. .

The posts considering the reduction of fossil fuels imported from Russia were published in March 2022, several weeks after the war in Ukraine commenced. These posts used images of oil tankers and protesting actions by activists supported by argumentative texts to communicate about the issue.

⁴⁵ Translated from Norwegian with DeepL. The original phrase is “Extinction Rebellion forlanger rask utfasing av produksjon på norsk sokkel - og umiddelbar letestans.”.

⁴⁶ Translated from Norwegian with DeepL. The original text is “Vi har ryddet i lageret og funne noen eksemplarer av boken “Europa uten gass” - skrevet av @tordhustveit. Vi gav denne ut sammen med Frekk forlag for noen år siden. Fremdeles aktuell”.

Only 5 out of 7 posts considering the transport theme discussed the pro-environmental actions. They focused on increasing cycling transportation, improving public transport, driving electric cars, and increasing air travel prices. In some posts, the organizations combined several solutions. For example, @greenpeacenorge stated: “Our politicians must **invest more in trains in Norway**. We need **more departures, cheaper tickets, better and faster trains**. At the same time, **it must become more expensive to fly** where there are more sustainable alternatives”⁴⁷.

Among 57 posts considering the solutions to the sustainability transition in the food, energy, and transport themes, we identified the following actors that should contribute to this transition, according to the environmental OLOs in Norway. These actors are represented by everyone or all people (including “we”/“us”), “you,” government, European countries, activists, politicians, and industries. The percentage of each actor is calculated in relation to the total number of posts considering solutions in the three sectors: food, energy, and transport (Figure 67).

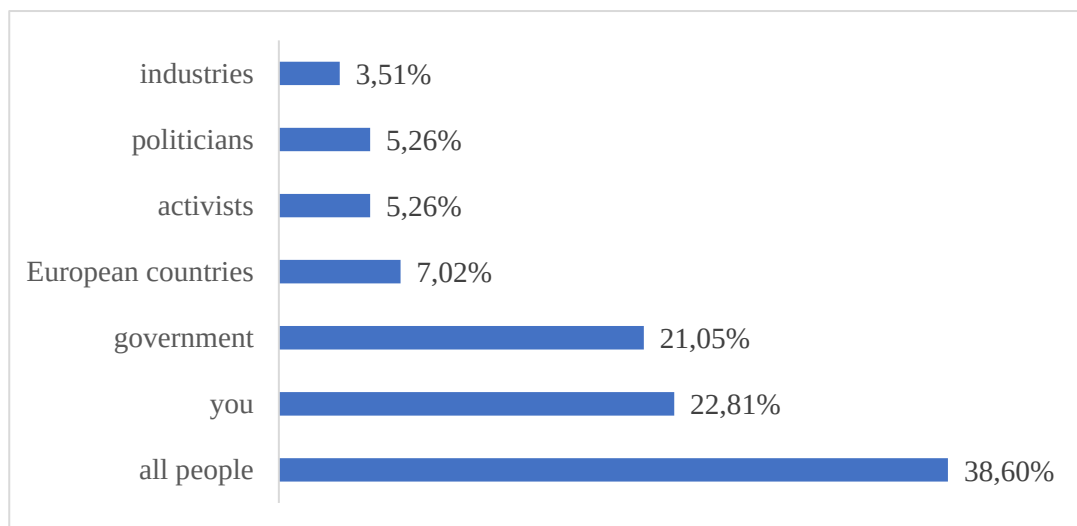


Figure 67 Actors responsible for CC mitigation mentioned in the posts by environmental OLOs in Norway, % of the total number of posts considering solutions (N=57)

⁴⁷ Translated from Norwegian with DeepL. The original text is “Politikerne våre må satse mer på tog i Norge. Vi trenger flere avganger, billigere billetter, bedre og hurtigere tog. Samtidig må det bli dyrere å fly der hvor det finnes mer bærekraftige alternativer”.

The importance of individual efforts was highlighted by attributed roles to different individuals, such as everybody or all people or “you” – the readers. The role of governments was underlined in the regulation of energy and food policies. Besides, the Norwegian organizations attributed an important role to other European countries that should also contribute to CC mitigation, yet without naming particular states. The role of industries and companies in sustainability transition was discussed in a few posts and was attributed to the fossil fuel and food industries.

6.3.2.3 Obstacles

The obstacles to pro-environmental behavior were evoked in 16 out of 68 posts considering food, energy, and transport spheres. In most of these posts, the enunciators indirectly introduced the obstacles. Among these obstacles, we observed such categories as wrong political action, corporate misbehavior, and actions or conditions of people. These obstacles were mainly introduced in the verbal component of the post: caption or text from the image. In the paragraphs below, we provide several prominent examples of obstacles in the posts by environmental OLOs in Norway.

Wrong political action was attributed to the actions of the government or certain politicians, which could not contribute to the SDGs. For example, @xrnorge posted on 19 August 2021: “The Breidablikk field, which will come ashore at Sture and for which **the government recently approved the development plans**, is scheduled to pump oil until 2044”⁴⁸. With this message, the movement did not directly identify the actions of the government as a barrier to CC mitigation. However, the audiences still could understand that the approval by the government of the continuous oil extraction will decelerate the reduction of fossil fuel exploration. The same message attributing responsibility and blame to the governments was posted by @greenpeace norge: “The IEA⁴⁹ has been the bible for Norwegian oil policy, where **politicians have used the agency’s analyses as justification for pumping more oil.**”⁵⁰

⁴⁸ Translated from Norwegian with DeepL. The original phrase is “Breidablikk-feltet, som skal ilandføres ved Sture og som regjeringen nylig godkjente utbyggingsplanene for, skal etter planen pumpe olje til 2044.”

⁴⁹ The International Energy Agency

⁵⁰ Translated from Norwegian with DeepL. The original phrase is “IEA har vært bibelen for norsk oljepolitikk, der politikerne har brukt byråets analyser som begrunnelse for å pumpe opp mer olje”.

Corporate misbehavior, or the actions by companies and industries, was mentioned by the OLOs as unethical actions undertaken by companies or industries, which can decelerate the sustainability transition. The @greenpeacenorge mentioned greenwashing by the fossil fuel companies as an obstacle, yet it was mentioned implicitly in the post's text: "GREENWASHING  **The oil industry is trying to tell you we need more oil to succeed with the green transition. This is greenwashing of the worst kind**, and we made that clear at Norwegian Oil and Gas' annual conference today"⁵¹.

In a previously introduced post by Greenpeace (Figure 66), the organization highlighted an essential role in reducing meat consumption and advertising for the sustainability transition in the food sector. In addition, the NGO blamed the meat industry for promoting meat consumption, which decelerates the sustainability transition in the food sector. The ONG began the post with the phrase: "While scientists are clear that our massive meat consumption is harmful to our health, nature and the climate, **the meat industry continues with large-scale advertising campaigns to influence us consumers to eat more meat.**"⁵²

In several posts, the organizations addressed the responsibility and blame for insufficient or controversial actions on the government and companies. In their post, @xr norge wrote on 19 April 2021: "**Nordic governments, banks, and fossil fuel companies are destroying nature**, causing death and sacrificing the future of all young people. It is an appalling crime against humanity. **Instead of acting, our governments remain passive towards the fossil fuel industry's greed**". In this text, the insufficient or 'passive' actions by the government contribute to harmful actions for the environment and humanity, which are conducted by companies, e.g., banks and fossil fuel companies.

⁵¹ Translated from Norwegian with DeepL. The original text is "GRØNNVASK  Oljeindustrien prøver å fortelle deg vi trenger mer olje for å lykkes med den grønne omstillingen. Det er grønnvasking av verste sort, og det ga vi klar beskjed om på Norsk olje og gass sin årskonferanse i dag".

⁵² Translated from Norwegian with DeepL. The original phrase is "Mens forskerne er klare på at det massive kjøttforbruket vårt er skadelig for helsa, naturen og klimaet, fortsetter kjøttindustrien med store reklamekampanjer for å påvirke oss forbrukere til å spise mer kjøtt".

Another example of an obstacle considering the government's and companies' actions was identified in a @greenpeacenorge post on 1 May 2021 (Figure 68). It was mentioned in the caption in the form of a rhetorical question: “Why **invest public money in the oil industry** when renewable projects generate more jobs, are climate-friendly and cheaper?”⁵³ Investing public money here is attributed to government actions that contribute to the deceleration of the energy transition. In the image to this post (Figure 68), the NGO used a meme to oppose the contributions from green projects (“grønne projekter”) on the left and the oil industry (“oljeindustrien”) on the right.⁵⁴ In fact, Greenpeace used *Swole Doge vs. Cheems* meme⁵⁵ to ironically visualize the comparison between two types of energy sources: with a dog having a muscular human body on the left signifying “good” green energies and a wily dog on the right signifying more broadly fossil fuels. The objectives of green projects (Figure 68, the dog on the left) here were complemented with the phrase: “We can fix 10 times more jobs than oil and gas”,⁵⁶ while the oil industries “struggle to create jobs but give us more money” (Figure 68, the dog on the right).

⁵³ Translated from Norwegian with DeepL. The original phrase is “Hvorfor investere offentlige penger i oljeindustrien når fornybare prosjekter genererer flere jobber, er klimavennlige, og dessuten billigere?”

⁵⁴ Translated from Norwegian with DeepL. The original phrase is “Vi sliter med å skape arbeidsplasser men gi oss mer penger”.

⁵⁵ <https://knowyourmeme.com/memes/swole-doge-vs-cheems>

⁵⁶ Translated from Norwegian with DeepL. The original phrase is “Vi kan fikse 10 ganger flere arbeidsplasser enn olje og gass”.

Vi kan fikse 10 ganger flere
arbeidsplasser enn olje og gass



GRØNNE PROSJEKTER

Vi sliter med å skape
arbeidsplasser men
gi oss mer penger



OLJEINDUSTRIEN

greenpeacenorge

greenpeacenorge

Hvorfor investere offentlige penger i oljeindustrien når fornybare prosjekter genererer flere jobber, er klimavennlige, og dessuten billigere?

Det er på tide å satse på grønne løsninger og en rettferdig omstilling til en mer bærekraftig økonomi, fri for undertrykking og ulikhet, som får med seg alle - inkludert arbeidere i forurensende industrier.

Figure 68 Post by @greenpeacenorge, 01.05.2021

Actions or conditions of other people indirectly referred to “accidental” actions by individuals. For example, @matvett.no suggested that **“The most common reason we throw away food is that we have forgotten about it. But if memory is the problem, it can also be the solution?”**⁵⁷. In this case, someone’s bad memory can indirectly contribute to food waste. Nevertheless, the organization proposed some tips to overcome this barrier and invited the readers to follow the link to the article in the profile.

In general, the entities responsible for their limited or insufficient contribution to the sustainability transition primarily comprised various collective entities. However, they were seldom mentioned in the posts by environmental OLOs, i.e., in 21 out of 68 analyzed posts about the sustainability transition in the food, energy, and transport sectors. Among these actors, the organizations proposed government (N=7), companies and industries (N=8) such as different banks, fossil fuel companies, shipping companies, or meat industry in particular, everyone or all people (N=4), Europe (N=2), and politicians (N=1).

⁵⁷ Translated from Norwegian with DeepL. The original phrase is “Den vanligste grunnen til at vi kaster mat, er at vi har glemt den. Men om hukommelsen er problemet, kan det også være løsningen? Les mer på matvett.no”

6.3.2.4 Values

In the majority of the analyzed posts by environmental OLOs in Norway, we observed a prevalence of biospheric values (66,18%) followed by egoistic (45,59%), altruistic (32,35%), and hedonic values (10,29%). The detailed statistics for each value item are reflected in Table 34. In the paragraphs below, we provide interesting examples for each value cluster.

Table 34 Observed values in the posts by environmental OLOs in Norway, % of the total number of posts regarding food, energy, and transport themes (N=68)

Value cluster	Value item	Number of posts in general (in %)		Number of posts in relation to obstacle (in %)	
Biospheric		45	66,18%		
	Unity with nature	-	-		
	Respecting the Earth	-	-		
	Protecting the environment	27	39,71%		
	Preventing pollution	18	26,47%		
Altruistic		22	32,35%		
	Health of all people	6	8,82%		
	Helpful to others	7	10,29%		
	World at peace	3	4,41%		
	Social justice	8	11,76%		
	Equality	-	-		
Egoistic		31	45,59%	14	20,59%
	Successful	-	-	-	-
	Social recognition	-	-	-	-
	Personal health	1	1,47%	-	-
	Ambitious	3	4,41%	1	1,47%
	Wealth	8	11,76%	5	7,35%
	Influential	1	1,47%	1	1,47%
	Authority	11	16,18%	3	4,41%
	Social power	9	13,24%	5	7,35%
Hedonic		7	10,29%	-	-
	Inner harmony	-	-	-	-
	Satisfaction of accomplishment	2	2,94%	-	-
	Comfort	-	-	-	-
	Self-indulgent	-	-	-	-
	Enjoying life	5	7,35%	-	-
	Pleasure	-	-	-	-

The Norwegian environmental OLOs from our corpus evoked *biospheric values* in most analyzed posts considering the food, energy, and transport sectors. The organizations generally mentioned the importance of environmental protection and preventing pollution in their texts. Besides the text itself, the following emojis 🌍, 🌱, 🍃, 🌿 were frequently attributed to the necessity to care for nature. In visual mode, the biospheric value was mainly visualized by the images from the @greenpeacenorge account. Concerning the biospheric value, the NGO

typically posted pictures of emissions from fossil fuel power plants, forests, seascapes, wild animals, birds, fish, and photos from protesting actions focused on nature protection.

In the analyzed posts, *altruistic value* signified the importance of social justice, being helpful to others (for example, farmers or activists), the health of all people, and the world at peace. The world at peace value item appeared in a few posts regarding fossil fuel import from Russia, which should be banned because it “is helping to finance the war in Ukraine,”⁵⁸ according to @greenpeacenorge on 30 March 2022. In an earlier post, the organization also used the #stopwar hashtag and photos from protesting actions to express the world at peace value item (Figure 69).

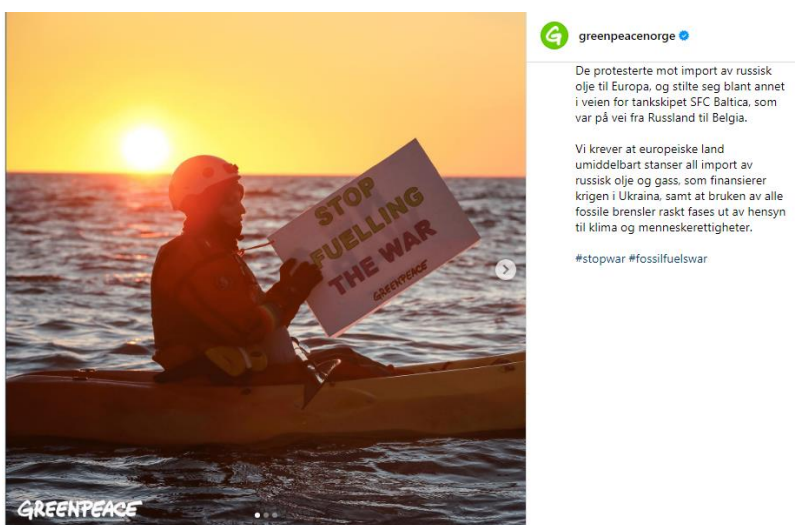


Figure 69 Post by @greenpeacenorge, 21.03.2022

In the majority of the posts, altruistic values were highlighted in the same way as biospheric values. An example of such combination can be illustrated by an extract from a @greenpeacenorge post on 18 July 2021: “The production and consumption of meat and dairy products **has a negative impact on the climate, the world’s forests, water, human health,**

⁵⁸ Translated from Norwegian with DeepL. The original phrase is “olje som er med på å finansiere krigen i Ukraina”.

animal welfare and fair distribution. 🌍💧👤.”⁵⁹ In this example, biospheric and altruistic values are highlighted by negative impacts from industries on nature and humans.

Another example of the biospheric value of protecting nature was visualized in the video with portraits of wild animals (Figure 70) and in the text by the phrases from the last paragraph:

“👤 At Greenpeace, **we expose and document the destruction of rainforests and endangered ecosystems**, and we put pressure on the companies and governments behind the destruction. We can do this thanks to the support of individuals like you. **If you want to contribute to our work for a greener future**, click on the link in bio @greenpeacenorge.”⁶⁰

The altruistic value of helping others was expressed in the last phrase, in which the organization emphasized the necessity of people’s support for their work.



Figure 70 Post by @greenpeacenorge, 09.03.2021

⁵⁹ Translated from Norwegian with DeepL. The original text is “Produksjonen og forbruket av kjøtt- og meieriprodukter har negativ innvirkning på klima, verdens skoger, vann, menneskers helse, dyrevelferd og rettferdig fordeling. 🌍💧👤.”

⁶⁰ Translated from Norwegian with DeepL. The original text is “👤 Vi i Greenpeace avslører og dokumenterer ødeleggelsen av regnskog og truede økosystemer, og vi legger press på selskaper og myndigheter som står bak ødeleggelsen. Det kan vi gjøre takket være støtten fra enkeltmennesker som deg. Vil du bidra til arbeidet vårt for en grønnere framtid, klikk på lenken i bio @greenpeacenorge”.

The altruistic value of social justice also appeared in a post by @greenpeacenorge regarding Women's Rights Day. The authors used such emojis as 🤝🤝🤝🤝 to highlight the "solidarity with women in vulnerable areas" ("Solidaritet med kvinner i sårbare områder"). The pictures of hands of different colors from this post contribute to the visualization of this altruistic value cluster. In the text to the post, @greenpeacenorge wrote: "Let's come together on Women's Day and fight for both women and the environment - women's struggle is climate struggle!"⁶¹



Figure 71 Post by @greenpeacenorge, 08.03.2022

Egoistic values in the posts by environmental OLOs in Norway were attributed to the importance of authority, social power, wealth, personal ambitions, and personal health. They were identified in 45,59% of the posts regarding the food, energy, and transport themes and were mainly combined with other values within the same post.

A post by @greenpeacenorge (Figure 72) on 22 February 2021 stated in the caption:

⁶¹ Translated from Norwegian with DeepL. The original phrase is "La oss komme sammen på kvinnedagen og kjempe for både kvinner og miljø – kvinnekamp er klimakamp!"

“Our planet looks very different when it is powered by renewable energy and not polluting fossil fuels. ☀️ **Fossil fuels**, which include oil, coal and gas, **are responsible for more deaths than any other source of air pollution in the world**. Meanwhile, **emissions from solar power are almost non-existent**. **Renewable energy is the cheapest source of electricity in most of the world - and the cleanest**. We demand renewable energy over fossil fuels so that the air we breathe is not dangerous to us!”

In this example, renewable energies adopted the role of a hero: @greenpeacenorge highlighted their positive influence on air quality (biospheric value – preventing pollution) and the financial benefits that can result from using renewable energies (egoistic value – wealth). In addition to this, the image from this post (Figure 72) opposed two possible worlds or scenarios. The first scenario on the top was represented by air polluted by fossil fuels (“luft forurensset av fossile brensler”). The second scenario involved the Earth supplied with solar energy (“jorden forsynt med energi fra solen”), which represented a bright, sunny, and cloudless future for humanity.

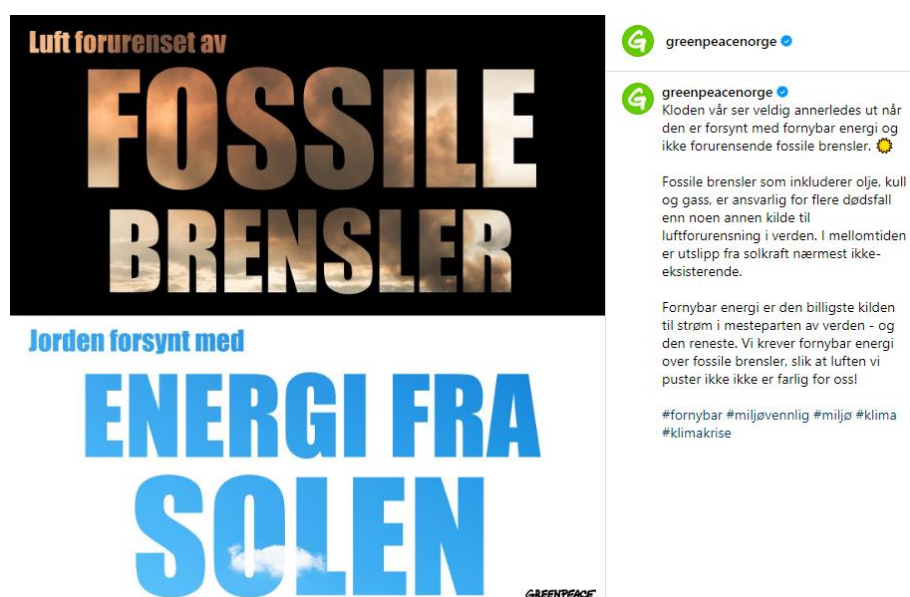


Figure 72 Post by @greenpeacenorge, 22.02.2021

Hedonic values in the observed data were attributed to the importance of satisfaction from accomplishment and enjoying life. Satisfaction of accomplishment was mainly introduced in the texts by highlighting the results of the work by organizations. Enjoying life’s pleasures, such as food, was predominantly illustrated by the photos of delicious vegetarian food accompanied by happy emojis, as demonstrated in Figure 73.



Figure 73 Post by @greenpeacenorge, 25.04.2021

Egoistic values were identified in relation to the obstacles in few posts. For example, a post by @greenpeacenorge on 22 August 2021 from Figure 74 emphasized the importance of financial profits for the oil industry (egoistic value), which, however, does not sufficiently contribute to CC mitigation and can be attributed to the obstacle category of actions of companies. In addition, @greenpeacenorge recognized the government's authority, which is necessary for the sustainability transition. While the biospheric value concerning preventing pollution was illustrated in the image from Figure 74, altruistic (health of all people) and egoistic values were mentioned in the post's caption. The caption from Figure 74 was translated by DeepL as:

“Our planet is worth more than the profits from fossil fuels 🌍 **The oil industry** has known for decades that their emissions are creating the climate crisis we are currently facing, yet **they choose profit over the health of people and our planet**. They spend millions on greenwashing and misinformation, ignoring the science that so clearly shows the damage they have done to our planet. It's time for polluters to take responsibility for all the damage they've caused, and **for governments to transition to a green future**. We have no time to lose. #climatecrisis”.

In this example, the egoistic value of wealth is related to the obstacle category of actions of companies.

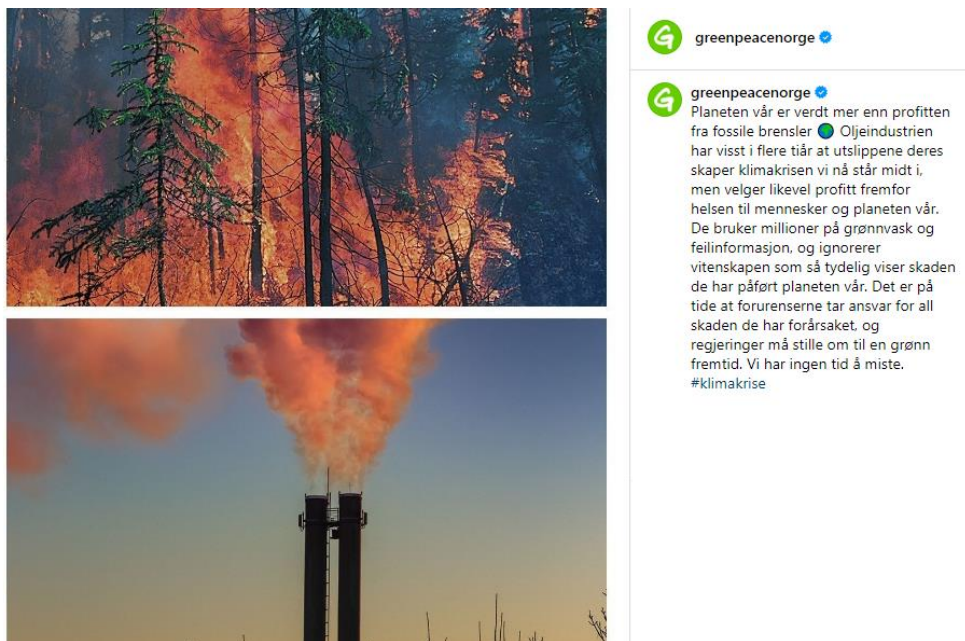


Figure 74 Post by @greenpeacenorge, 22.08.2021

Another example of egoistic value appeared in a post by @greenpeacenorge on 2 December 2021; the NGO wrote: “While scientists are clear that our massive meat consumption is harmful to our health, nature and the climate, **the meat industry continues with large-scale advertising campaigns to influence us consumers to eat more meat.**”⁶² In this phrase, Greenpeace attributed the egoistic value item of influence to the meat industries, which use advertisements to influence people’s food habits. According to another post by Greenpeace, the authority value item was related to the International Energy Agency and used by the government to justify controversial policies. They posted: “The IEA⁶³ has been the bible for Norwegian oil policy, where **politicians have used the agency’s analyses as justification for pumping more oil.**”⁶⁴

⁶² Translated from Norwegian with DeepL. The original text is “Mens forskerne er klare på at det massive kjøttforbruket vårt er skadelig for helsa, naturen og klimaet, fortsetter kjøttindustrien med store reklamekampanjer for å påvirke oss forbrukere til å spise mer kjøtt”.

⁶³ The International Energy Agency

⁶⁴ Translated from Norwegian with DeepL. The original phrase is “IEA har vært bibelen for norsk oljepolitikk, der politikerne har brukt byråets analyser som begrunnelse for å pumpe opp mer olje”.

Broadly speaking, we observed different combinations of environmental values within the same post and illustrated these co-occurrences in Figure 75. This graph demonstrates the proximity between biospheric, egoistic, and altruistic value clusters in the analyzed data. That is to say, these values were more frequently utilized in combination in one post. For example, protecting the environment of the biospheric value cluster was frequently used in combination with social power egoistic value item. Simultaneously, hedonic values (such as enjoying life) were combined with biospheric (protecting the environment or preventing pollution) value items.

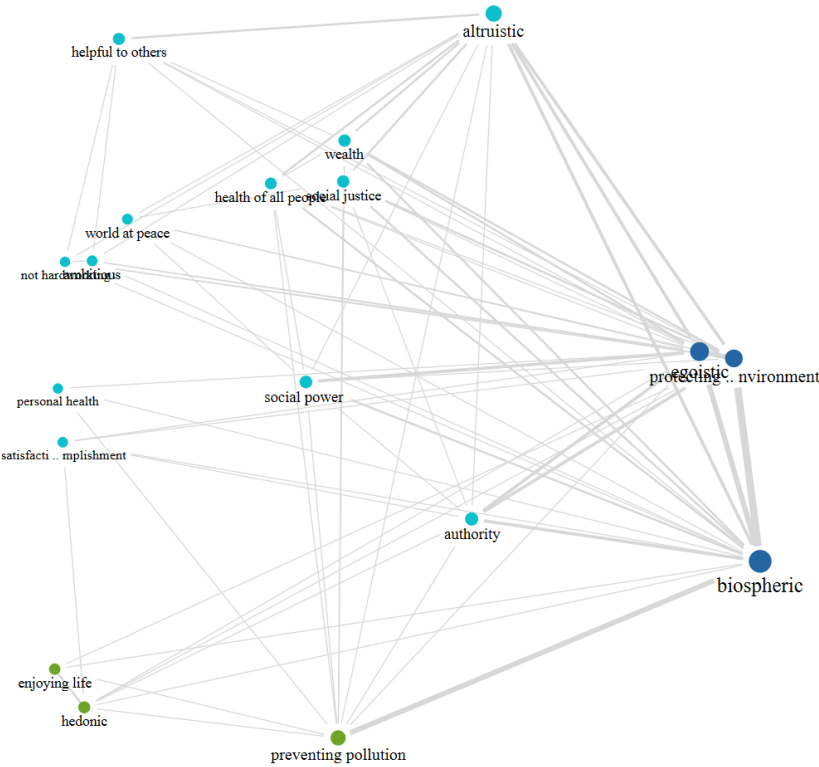


Figure 75 Co-occurrence networks of values in the posts by environmental OLOs in Norway

To conclude, although the number of posts considering the food, energy, and transport themes by the environmental OLOs in Norway is smaller than other subcorpora for this research, we could still observe different tendencies in their messages. The most frequently discussed themes in this subcorpus were related to the food and energy sectors. The organizations highlighted the importance of different individual and group actions for the sustainability transition, such as reducing food waste, reducing energy production from fossil fuels, and improving transportation with public transport. All people, “you,” and the government were identified as the main actors to contribute to CC mitigation. Governments and fossil fuel industries were

most frequently attributed responsibility and blame for the climate crisis, and their insufficient actions were identified as significant obstacles to pro-environmental action. Biospheric values were the most frequently present in the analyzed posts, mainly visualized by air pollution and pictures of nature. Although not numerous, egoistic and hedonic values were related to the identified obstacles.

Norway: Key findings

- Food was the most frequently discussed theme by the environmental OLs and OLOs.
- The most discussed solutions by the environmental OLs were adopting plant-centered diets, declining fossil fuel production, and improving public transport infrastructure.
- The most discussed solutions by the environmental OLOs were decreasing food waste, decreasing fossil fuel development, and increasing cycling transportation.
- The transport theme was the second frequent theme communicated by the environmental OLs. Politicians communicated about it more frequently than other individuals.
- The environmental OLs emphasized the role of all people' and "you" (the audience) in contributing to CC mitigation, who were most frequently mentioned as actors responsible for CC mitigation.
- The environmental OLOs emphasized the role of all people, "you" (the posts' readers), and the government as the main actors for CC mitigation.
- The obstacles in the posts by environmental OLs included wrong political action, corporate misbehavior, money, time, social judgment, and misinformation.
- The obstacles identified in the posts by environmental OLOs included wrong political action, corporate misbehavior, and individual conditions.
- The main criticized entities by environmental OLs and OLOs were companies, government, and politicians.
- Biospheric values were the most frequent in the posts by environmental OLs and OLOs.
- Egoistic and hedonic values were linked to the observed obstacles in the posts by environmental OLs and OLOs.
- In both subcorpora, the obstacles were more frequently mentioned in the posts' texts or text-on-image elements, yet sometimes supported by the visuals.

6.4 Discussion of the results

In this part, we reflect on the obtained results from a multimodal content analysis of the posts by environmental OLs and OLOs regarding the sustainability transition in three sectors, food, energy, and transport, in Belgium, France, and Norway between January 2021 and March 2022. First, we compare and contrast the analysis results regarding the three countries provided in Sections 6.1–6.3. Then, we address the research methodology and discuss the specificities of Instagram.

6.4.1 Reflecting on the findings from multimodal content analysis of the posts in

Belgium, France, and Norway

In this part, we compare and contrast the results obtained with a multimodal content analysis of the posts considering the food, energy, and transport sectors in Belgium, France, and Norway presented in Sections 6.1–6.3. Specifically, we address our **contributory research question 1**: What are the tendencies in Instagram posts by environmental OLs and OLOs concerning climate actions in the three sectors? To do so, the discussion is structured according to the questions elaborated for the data analysis. We start by reflecting on CC and environment-related themes, then we discuss climate solutions and actors, and we finalize with the reflection on the obstacles and values.

CC-related themes

Among almost all types of enunciators in the three countries, the food sector achieved the highest attention in the posts by environmental OLs and OLOs, except the environmental OLOs in Belgium, who tended to post more about the energy sector in *Corpus21-22_FET*. The popularity of food-related themes in all data by environmental OLs in the three countries can be explained by the nature of the theme: food is a common theme in many cultures to discuss in small talk, and it is the closest theme for each individual. People generally do not change their energy providers or take transport multiple times a day. Meal cooking, however, can be considered the most frequent activity by an ordinary person who may not take public transport to work but still needs to prepare meals several times a day. Another explication of the popularity of the food theme in French culture can be related to the vital role of food, which shaped French culture (Abramson, 2007). In Norway, a high percentage of food-related subjects can also be related to a high number of posts about CC and food-related subjects by a particular

account, @gunhild_stordaelen, who is involved with public debates about CC, public health, and global food systems.

We summarized the percentages of each thematic category, i.e., food, energy, and transport, concerning the number of posts considering CC and environment in Table 35. In the paragraphs below, we reflect on the presented tendencies.

Table 35 Distribution of themes in the Corpus21-22_FET

Enunciator by country	Food	Energy	Transport	Number of posts about all themes considering environment and CC
Belgium				
OLs	39%	35%	15%	276
OLOs	29%	40%	23%	296
France				
OLs	51%	17%	19%	573
OLOs	34%	30%	19%	421
Norway				
OLs	55%	16%	25%	122
OLOs	41%	34%	7%	87

Energy was the second most popular theme in several subcorpora, such as OLs in Belgium, OLOs in France, and OLOs in Norway. Interestingly, the OLOs in Belgium tended to discuss the energy themes more than in other countries (40% of the posts). However, the energy theme was the least popular among the OLs in France and Norway, which may be seen as uninteresting for individuals to discuss the energy sources in January 2021–March 2022. We estimate that the number of posts considering the energy sector increased in 2022 since the beginning of the war in Ukraine, which resulted in the economic and energy crises in Europe. Already in March 2022, we observed a relatively slight increase in the posts considering the energy sector by both environmental OLs and OLOs. Although several statistics claim the increase in the number of media articles regarding the war in Ukraine started in February 2022, they focus predominantly on the nuclear weapon mentions (Statista Research Department, 2024) or trends in social media attention on the war without specifying the energy crisis (Perrotta Berlin & Lehne, 2024). We can only suppose that the energy crisis that appeared in Europe after the Russian invasion of Ukraine possibly contributed to the increase in the number of posts considering the energy sector on Instagram, as in the case of the global crisis of 2008, which resulted in the increased the number of posts on Reddit considering the energy sector (Kaushal et al., 2022).

Considering different groups of environmental OLs, the analysis has shown that politicians in Belgium and Norway tended to discuss energy or transport themes, and creative professions/activists discussed preferably the sustainability transition in the food sector. Activists and people pursuing creative professions or combining both activities largely discussed other subjects relevant to the sustainability transition, such as sustainable fashion or protest actions. Contrary to our expectations, politicians in Norway discussed the transport theme more frequently than the energy theme. On the one side, we can link this result to a more minor amount of data collected for the Norwegian subcorpus. On the other side, this increased number of posts considering the food and transport themes by OLs in Norway can be related to the parliamentary elections campaigns: the politicians from the Green Party focused on transport and food sustainability policies during the campaign (The Green Party, 2024).

RQ 1.1: Which climate actions related to solutions to CC mitigation are represented in the posts?

In general, most of the analyzed posts by environmental OLs and OLOs in Belgium, France, and Norway were solution-oriented: on average 88% of all analyzed posts included solutions to CC mitigation. The Norwegian posts by environmental OLs were the most solution-oriented, with suggested climate actions in 96% of the posts. In all posts with solutions, the enunciators highlighted the possible solutions to the sustainability transition in the three sectors and suggested the actors responsible for contributing to CC mitigation. These solutions were either individual or group efforts.

In the food sector, all proposed efforts directed at CC mitigation can be summarized into four categories: 1) reducing meat consumption, 2) developing agriculture, 3) consuming sustainable food products, and 4) organizing sustainable cooking. These actions are recapitulated in Figure 76. In the paragraphs below, we delineate several specificities between each country.

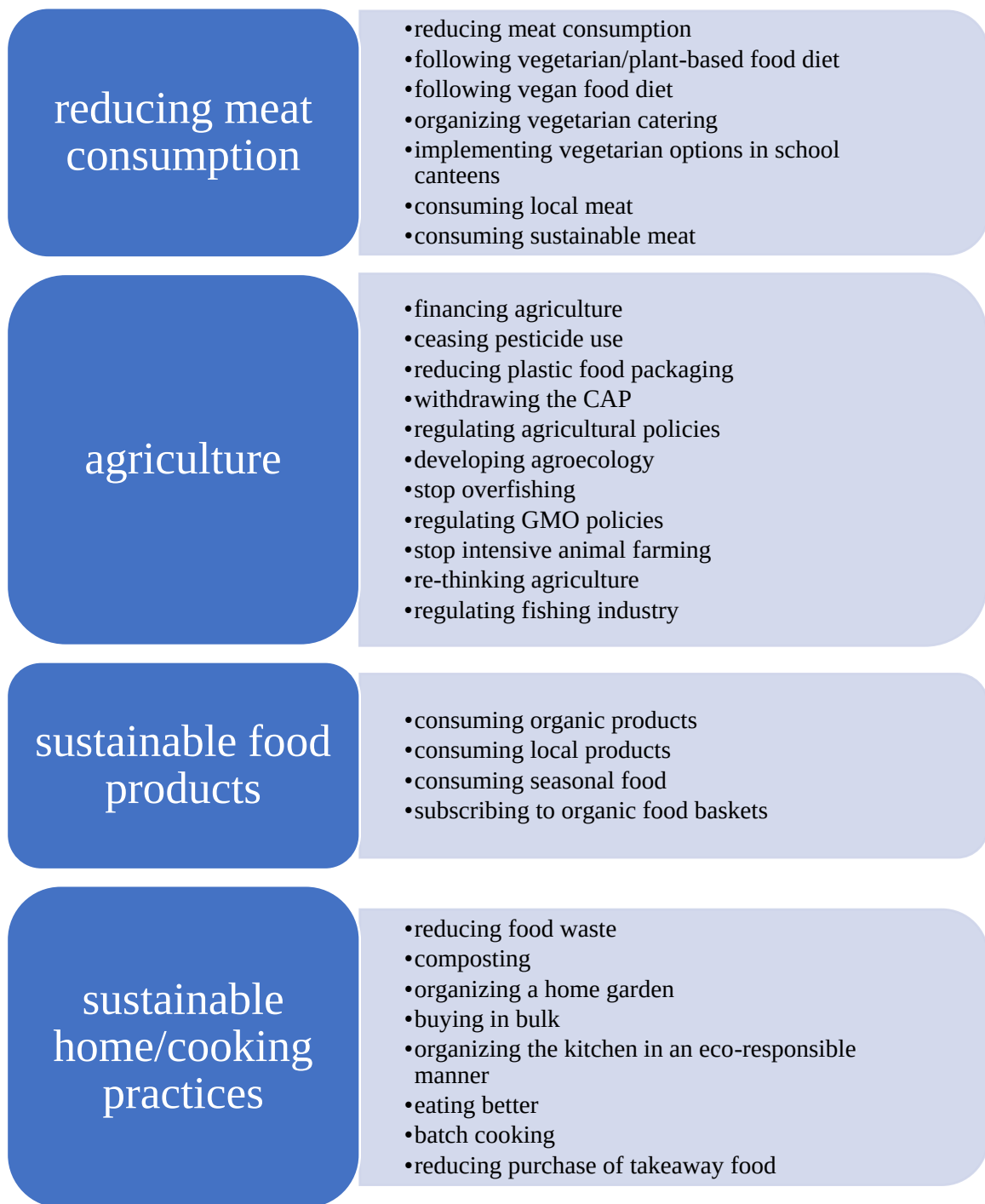


Figure 76 Solutions in the food sector proposed by environmental OLs and OLOs in Belgium, France, and Norway

The most extensive list of solutions was proposed in the Belgian subcorpus, which combined more general food practices to CC mitigation efforts – such as following vegetarian diets, reducing meat consumption, reducing food waste, or consuming local, seasonal, or organic

foods – with rather specific actions like organizing the kitchen in an eco-responsible manner, ceasing plastic packaging for the food products, or developing vegetarian catering options.

Although the OLs and OLOs in the three countries more frequently discussed reducing food waste and consumption of local, seasonal, organic products, the French and Norwegian environmental OLs discussed mainly following vegetarian diets or reducing meat consumption. Interestingly, only 10% of French citizens attributed reducing meat consumption to a sustainability transition in the food sector in 2023, according to L'Observatoire Société & Consommation (2024). Regarding the message framing, individuals and organizations in the three countries more frequently adopted the *following vegetarian or plant-food diets* message framing than *reducing meat consumption*. As Krpan and Houtsma (2020) suggested, using the “eating more vegetables” framing can positively influence vegetarian food choices.

Eating local or organic meat was proposed mainly in France and in a few posts in Norway. The promotion of consuming local and organic meat in France is largely supported by the *Interbev*⁶⁵ communication campaigns, which might influence the appearance of this theme in our data. In Belgium, the OLs and OLOs did not specify organic or sustainable meat consumption.

Regarding the group actions in the food sector, the three countries highlighted the necessity of financial support for agriculture, ceasing pesticide use, and decreasing plastic packaging for food products. The OLs in Belgium and Norway have particularly discussed reducing plastic packaging for food products. Other studies have also demonstrated the rise of social media discussions regarding plastic waste, particularly on Reddit, since 2020 (Kaushal et al., 2022). However, the study by Kaushal et al. (2022) did not specify the country and research language, which does not allow us to compare our results to other countries.

A global European action targeted at the withdrawal of the Common Agricultural Policy was discussed mainly in Belgian posts and in several posts in France, which may be related to the membership of these countries in the EU.

Most of the individual actions in the food sector emphasized concrete solutions. However, the majority of group actions were ambiguously deliberated. Such proposed actions

⁶⁵ An organization promoting local and organic meat consumption in France, called Interprofession bétail & viande, i.e., L'Association nationale interprofessionnelle du bétail et des viands (<https://www.interbev.fr/>)

as preventing food crises, fixing food, or developing agroecology were introduced in the posts without any concretization of what precisely the action comprised. Agroecology is a term that particularly appeared in the French and Belgian data, however without a specific definition of the solution.

In the energy sector, all proposed actions can be synthesized into five categories: fossil fuels, renewable energies, nuclear energy, construction and energy use, and sustainable energy. The detailed actions within each category of proposed solutions in the three countries are illustrated in Figure 77.

Fossil fuels (FF)	Renewable energies (RE)	Nuclear energy (NE)	Construction and energy use	Sustainable energy
•stop investing in FF •stop development of FF •stop development of coal mines •stop advertizing FF •stop importing FF from Russia	•develop RE •support RE financially •develop batteries recycling •develop RE storage solutions •no offshore windmills	•no use of NE •use safe NE	•reduce energy use •optimize building construction •improve energy labels •repair electric devices •use alternatives to streaming •use locally-produced energy •use solar electric devices	•improve energy transition •resolve energy insecurity •decarbonize energy •regulate energy policies

Figure 77 Solutions in the energy sector proposed by environmental OLs and OLOs in Belgium, France, and Norway

In all countries and by all enunciators, we observed a typical scheme of discussion of fossil fuels and renewable energies. The authors highlighted the transition from fossil fuel energies – which can be done by reducing the development of new infrastructures or ceasing financial support – to renewable energies, which require financial support and improvement of storage solutions. Nuclear energy was less evoked in the posts and was specifically discussed in the French and Belgian data. Indeed, the debates around nuclear energy are widely present in these two countries. In addition, regarding the three countries, we observed that the environmental OLs tended to discuss the development of renewable energies, but the environmental OLOs –

decreasing fossil fuel production. These findings correspond to the framing analysis results of Instagram posts under the English- and German-speaking posts with the #energiewende hashtag by Schmid-Petry and Zehe (2024).

Several specific actions in the energy sector at an individual level were proposed in the French data. For example, repairing electric devices, using alternatives to streaming, solar electric devices, or locally-produced energy were emphasized in several posts by environmental OLs in France.

In Belgium and France, fossil fuels were particularly discussed by organizations, while renewable energies and solutions were predominantly discussed by individuals. The analyzed posts emphasized 1) the economic and climate risks associated with fossil fuels and 2) the benefits of renewable energies for energy security and combating climate change. Fossil fuels and nuclear energy were frequently opposed to renewable energy sources within the text of the same post. For example, an extract from a post by @youth.for.climate (Belgium) says: “**We can not support any investments in new fossil fuel infrastructure** in the midst of a climate crisis ... **Belgium needs to shift to 100% renewables** as soon as possible”. In the first part of this extract, the movement refuses financial support for new fossil fuels; in the second part, they highlight the necessity of the transition to renewable energies.

Fewer actions were observed in the posts by environmental OLs and OLOs considering the transport sector in the three countries. Although transport was the second most frequent theme in two out of six two subcorpora (the OLs in France and OLs in Norway), the proposed actions in this sector were not numerous. These actions can be grouped into five thematic categories: public transport, bike use, car use, airplane travel, and other sustainable travel efforts (Figure 77).

Public transport (PT)	Bike use	Car use	Airplane travel	Other sustainable travel efforts
•development of train infrastructure •financing PT •decarbonizing PT •more frequent train use •development of PT •accessible and affordable PT •electric PT •hydrogen fuel for PT •more space for bikes in trains	•more frequent bike use •development of cycling infrastructure •subsidies for electric bikes	•electric vehicle use •reducing individual car use •co-driving, car-sharing •no fossil-fuelled cars	•reducing individual travel by plane •no airport extensions •increase prices of airtravel	•sustainable travel •improvement of batteries for electric vehicles •no fossil-fuelled transport •no advertising of polluting vehicles •visualizing eco-transport on Google Maps •regulation of transport policies

Figure 78 Solutions in the transport sector proposed by environmental OLs and OLOs in Belgium, France, and Norway

As in the food and energy sectors, more concrete actions were proposed in the French subcorpus of posts by environmental OLs and OLOs. In France and Norway, the posts considering transportation were frequently shared by politicians of the green parties announcing their promises during the electoral campaigns.

In the transport sphere in Belgium and France, both individuals and organizations actively promoted individual actions. Nevertheless, the French data was more specific about the proposed actions and included the description of co-driving and car-sharing practices or the improvement of *Google Maps* to visualize and promote eco-responsible means of transport. Although there is a lot of enthusiasm in the media regarding the use of electric vehicles in European countries (J. Schreiber et al., 2023; Villareal, 2011), the debate about the use of electric vehicles is not widely discussed in the analyzed posts. It is interesting how Belgian and French OLs and OLOs framed their posts considering individual car use. In some posts, they highlighted the ban of fossil-fueled cars “**mettre fin à la vente des véhicules essence, diesel et hybrides neufs en 2023**” (post by @reseauxactionclimat, 07.01.2022). In other posts, they emphasized the role of electric cars, which is still weak but recognized: “**La voiture électrique n’est pas non plus une aubaine, et elle n’a du sens que dans certains contexts**” (post by

@ecolo_mon_cul, 24.03.2022). In a few posts, these actions were used as an opposition between “bad” fossil-fuelled cars and “better” electric vehicles:

“Pour rappel, selon une vaste étude de Transport et Environnement (T&E) [...] **les données penchent nettement en faveur de l’électrique**. Dans le pire des cas, avec une batterie produite en Chine et conduite en Pologne, où l’électricité est surtout produite avec du charbon, une voiture électrique émet 22% de CO₂ de moins qu’un véhicule diesel et 29% qu’un véhicule essence, sur sa durée de vie totale” (post by @lesbellesnouvelles, 21.07.2021).

Overall, the environmental OLs and OLOs in the three countries discussed multiple solutions from different sectors in their posts. This large number of information presented within one post could also contribute to a general presentation of solutions rather than their specifics. Nevertheless, the environmental OLs proposed relatively more concrete individual and group actions in the food, energy, and transport sectors in the three countries. As in a recent study by San Cornelio and colleagues (2024), such influential individuals promoting sustainability assume that individual efforts can contribute to CC mitigation (San Cornelio et al., 2024), which can also be related to the positive impact of solution-oriented images of the posts (S. O’Neill et al., 2013). The most ambiguous or less described actions, such as “sustainable travel,” “sustainable food,” “agroecology,” or “sustainable transportation,” were considered predominantly group actions and were mainly discussed in the posts of organizations.

RQ 1.2: Which actors are represented as responsible for CC mitigation?

In the posts by environmental OLs and OLOs in Belgium, France, and Norway, we identified different individual and group actors responsible for different efforts to mitigate the effects of CC. In Belgium, the government was most frequently mentioned by the OLs and OLOs as a main actor for the climate or a “hero.” Contrary to Belgium, the most frequently responsible actors for CC mitigation in France and Norway were such actors as “you,” the readers, or all people. Both organizations and individuals in France and Norway emphasized the necessity of individual action. Yet, the government is the second most frequently mentioned actor in France and Norway. In the majority of the posts by the French OLs, the enunciators proposed personal examples, opinions, and attitudes towards efforts related to CC mitigation: This could positively induce a behavioral change in their readers (Belanche et al., 2021).

In all investigated subcorpora, collective or group actions were more frequently addressed by environmental OLs and OLOs to the governments, agriculture workers,

companies, or the EU. These actions were more frequently addressed in the form of demand, i.e., emphasizing that these actors should contribute to the solutions.

The role of the EU in regulating the climate crisis was particularly highlighted by the posts of Belgian environmental OLs and OLOs, which can be explained by the country's central position within the EU: the offices of most of the decision-making institutions of the EU are located in Belgium.

It is interesting that the role of companies in CC mitigation is differently represented in the analyzed data. The individuals in Belgium and Norway mentioned companies as responsible actors twice as much as the organizations in the same countries. In the French discourse, organizations discussed the critical role of companies in CC mitigation in their posts.

In summary, the identified actors responsible for CC mitigation in our data are closely connected to the categories of *current hero* and *potential future hero*, as proposed by Gjerstad & Fløttum (2021). Current heroes, i.e., actors contributing to CC mitigation today, can be represented by “me-myself” in the analyzed posts, whose actions reflect the proposed solutions. Contrary to San Cornelio, Martorell, and Ardèvol's (2024) research, only a small part of the environmental OLs in our data identified themselves as eco-activists. Nevertheless, all of them assumed that individual pro-environmental actions could largely contribute to climate change mitigation. The governments, companies, and the EU were more frequently discussed as potential future heroes, i.e., the ones whose action is important and who need to contribute to CC mitigation but who are not applied in this action today. The action addressed to them is usually in the form of a demand for change. “You,” the readers, represented a *current hero* in several posts, where authors introduced a discussion with other people in the posts, and both actors discussed their contribution to CC mitigation, or when the author concluded the post with the question “What do you do to reduce your carbon footprint?” With this question, the authors assumed that their audiences contributed somehow to CC mitigation and opened a discussion with them in the comments. In other posts, “you” was suggested as a potential future hero. In particular, when the organizations recommended to their readers that they reduce their meat consumption or follow vegetarian food diets.

RQ 1.3: Which obstacles to pro-environmental action are represented in the posts?

In the predominant part of the posts by environmental OLs and OLOs In Belgium, France, and Norway, the authors did not discuss specific obstacles or barriers to CC mitigation. The

obstacles appeared in only 20% of the posts by environmental OLs in Belgium and 30% of the posts by environmental OLs in France and Norway. The organizations tended to discuss more obstacles to CC mitigation in their posts. We identified different obstacles in around 35% of the posts by the organizations in the three countries. Overall, a large variety of obstacles appeared in the corpus of posts by French environmental OLs and OLOs, which is unsurprising considering that this subcorpus is the largest within our dataset.

The majority of the identified obstacles were related to collective actions, particularly those present in organizational discourses. The obstacles identified in the posts by environmental OLOs were generally related to the actions of the governments, political leaders, and companies. In addition, the OLOs more frequently discussed the obstacles related to the energy sector, i.e., the transition from fossil fuel energies to renewable energy sources.

On the individual level, the obstacles were more frequently related to the food sector, particularly to the adaptation to vegetarian diets, consumption of local organic products, or reducing food waste.

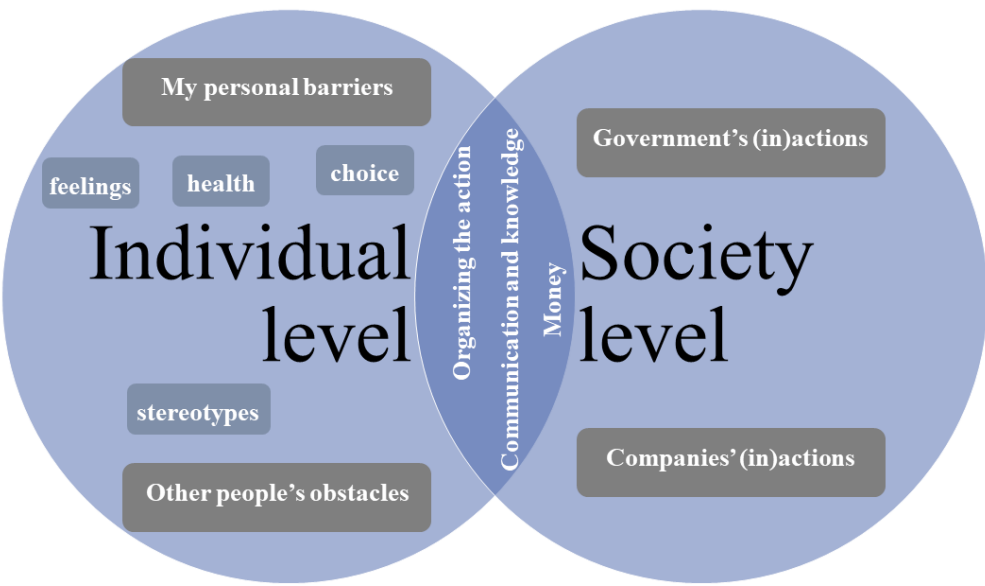


Figure 79 Scheme of obstacles to CC mitigation

In Figure 79, we propose a synthesized scheme of different obstacles that appeared in the posts by environmental OLs and OLOs in Belgium, France, and Norway. The obstacles can be divided into two large categories: obstacles at an individual level and obstacles at a collective

level. The individual obstacles are related to the barriers appearing to particular individuals, which can be *my personal barriers*, or the barriers mentioned as personal by the post's author, and the *other people's barriers*, which are related to other people's actions. Different barriers appeared on the individual level, such as health, feelings, choice, or stereotypes.

Personal health as a barrier was frequently adapted to the vegetarian food diets, where people claimed that their or other people's low iron level could be a significant barrier to reducing meat consumption. While health is generally related to the motivation to reduce meat consumption (Bryant et al., 2022), in some examples from our data, it sometimes appeared as an obstacle to following vegetarian diets.

Personal feelings, such as anxiety, guilt, or frustration, were primarily identified in the French subcorpus by environmental OLs and were mentioned as individual factors demotivating the efforts for pro-environmental action. Such psychological barriers are sometimes called "dragons of inaction" (Gifford, 2011).

The stereotypes were closely related to social judgment and personal feelings. In particular, they addressed other people's actions, which may discourage the author's pro-environmental action. Although these social norms are frequently viewed as barriers to climate action, they can also be a part of the solution in cases when the representations of social norms are carefully chosen for communication (Sparkman et al., 2021).

At a societal level, the OLs and OLOs more frequently mentioned the actions or inactions of the governments, individual political leaders, or companies. It is interesting that Belgian and French environmental OLs and OLOs did not hesitate to mention specific names of the companies whose actions do not contribute to CC mitigation. In Norway, the environmental OLs and OLOs did not provide any specific name of politician or company whose actions are represented as barriers to CC mitigation.

Organizing the action, communication and knowledge, and money are three transversal barriers that are closely connected to both barriers at the individual and societal levels. Organizing pro-environmental action is a time-consuming process that demands the development of various infrastructures, which, in turn, are not always practical or optimized solutions, according to the environmental OLs and OLOs. Communication and knowledge-related barriers depicted inconsistent or controversial communication about the solutions to CC mitigation, which could influence the obstacles on both individual and societal levels. The problems related to communication, particularly concerning the IPCC, were highlighted by

Sterman (2011), who emphasized the presence of confusion and denial among policymakers and the public. The researcher recommended reducing technical jargon and prior graphics testing by communication professionals in communicating about CC (Sterman, 2011). In addition, the studies in the USA demonstrated the negative influence of media fragmentation and the enormous amount of media sources on communication about CC (Bolsen & Shapiro, 2018).

The money obstacle category on an individual level generally implies a lack of financial resources necessary for the transition at an individual level, e.g., buying local organic products, which are generally more expensive than the food in supermarkets. This obstacle also appeared in other studies by Semenza et al. (2008), who emphasized the lack of financial resources for the US citizens to contribute to CC mitigation, and by Gilmore and St. Clair (2018), who identified low budgets within the US government level attributed to regulate policies concerning the climate crisis.

In most posts, the obstacles were either directly or indirectly introduced in the post's caption, text within the image, or video. They never appeared in a still image without textual overlay. This fact can confirm our **Hypothesis 2**:

The obstacles will be more clearly stated in the verbal mode of the posts, i.e., captions or text-on-image elements, on Instagram.

In the analyzed posts within the three countries, the obstacles were sometimes accompanied by emojis of confused or angry faces, such as 😕, 😞, 😠, 🙄. However, without the post's text and the image, it was impossible to say that they were directly linked to the obstacles. In the context of the posts' meanings, these emojis can be seen as discursive markers of obstacle discourse. Similar results were found in Twitter data in Belgium, France, and Norway, where 😕 emoji represented the expression of difficulty linked to CC action (Pizarro Pedraza et al., 2022).

In addition to the identified obstacles, we also observed several actors criticized by the environmental OLs and OLOs for their irresponsible behavior toward CC mitigation. These actors can be related to the categories of *past* or *current villains*, as suggested by Gjerstad and Fløttum (2021). Although some studies underlined the rise of different forms of criticism on Instagram (Davidge, 2018; Feldman, 2021), our data demonstrated a low level of criticism in

the posts. Nevertheless, we could still observe several tendencies appearing in the analyzed posts.

In general, we observed that the posts by organizations implied more critical opinions and identified past or current villains within them. For example, collective or group actors, such as governments, companies, and politicians, were named as responsible for their inaction in the three countries, Belgium, France, and Norway. In several examples considering the governments inaction towards CC mitigation, the OLs and OLOs used war metaphors when addressing climate issues: “la France **mène le combat**”, “Vous ne m’entendrez jamais dire que **le combat est terminé**, mais nous franchissons aujourd’hui une étape importante”.

Regarding the companies in the role of villains, they were represented mainly by fossil fuel industries, banks, fast fashion brands, supermarket chains, and airline companies in the three countries. These companies are almost always represented as past and current villains and only in a few posts as future heroes. At the same time, the governments, farmer workers, and the EU are always represented as past and current villains and potential future heroes.

RQ 1.4: Which environmental values are represented in the posts?

Overall, the environmental values in each subcorpus were represented by a variety of combinations of biospheric, egoistic, altruistic, and hedonic values. Biospheric values, such as protecting the environment or preventing pollution, appeared as trending values in the majority of the posts in all countries. Both environmental OLs and OLOs in Belgium, France, and Norway emphasized the importance of caring for nature and the environment. These values were frequently represented by impacts on nature from harmful activities by people. According to Chapman et al. (2016), such images of impacts can motivate greater intentions toward personal behavioral change.

Egoistic values in the analyzed posts reflected the importance of money, personal influence, authority, and social status for people in the analyzed posts. In some posts, they were attributed to the authors of the posts and their desire to spend money on pro-environmental action or the ambitions to work hard for CC mitigation. In other cases, the author attributed these value items to other actors, particularly when the authors discussed the obstacles and the actors contributing to them by explaining why other people do not contribute to climate action.

As biospheric values, altruistic values appeared predominantly in the verbal modes, yet frequently in the images showing other people’s solidarity or participation in collective action.

In most posts in the three countries, the OLs and OLOs highlighted the necessity of being helpful to others and social justice. In fact, social justice went hand in hand with climate action in the posts by organizations and social movements. Indeed, social and climate justice are fundamental for CC mitigation and are frequently used in communication by climate movements and NGOs (Chen, Molder, et al., 2022; Shah et al., 2021; Smiles & Edwards, 2021).

Hedonic values were less frequently expressed in the posts in comparison to other value clusters, and they were mostly assessed by the desire to have fun, be in comfortable conditions, or be satisfied with accomplished action. This satisfaction was always directly attributed to the person's individual efforts to mitigate CC.

Compared to biospheric or altruistic values, which are easier to visualize by pictures of nature or a group of people involved in the activity, the egoistic and hedonic values in this data appeared typically in verbal modes. In visual modes, the pleasure from food sometimes appeared in the images of attractive food recipes. The icons of money were seldom used in the images, which could enhance the egoistic value mentioned in the text.

To summarize, all four categories of values were present on Instagram communication by environmental OLs and OLOs, with a particular emphasis on biospheric, egoistic, and altruistic values. Indeed, communication strategies addressing these three types of values are often considered motivating factors for pro-environmental behavior (Marshall et al., 2019).

RQ 1.5: Which values appear in relation to the identified obstacles to pro-environmental behavior?

Identifying the values concerning obstacles to pro-environmental action was complicated by several factors. First, the combination of multiple values within one post could complicate their interpretation. This factor was particularly observed during the analysis of the Norwegian data, which was translated into English for the analysis, and the identification of a value or the obstacle within multiple present values of the post was a complicated procedure. Second, the difference between several value items is very delicate and could also influence the identification of the value items. For instance, the value items *pleasure* and *enjoying life* of the hedonic value cluster can demonstrate semantic equivalence: both are directly related to people's desires. However, while the *pleasure* value item is rather generalized by the meaning "It is important to have fun," the *enjoying life* value item is concretized by different life pleasures, such as food or leisure. In our data, the *enjoying life* value item was generally

attributed to enjoying food or the displeasure in vegetarian food options, which concerned obstacles. Third, identifying the values is a qualitative process that largely depends on the researcher's cultural experience. Therefore, these results could benefit from an additional examination by native citizens of each country. Although it can be difficult to generalize the results considering values in relation to obstacles to CC mitigation, in the paragraphs below, we present several trends that appeared in the posts by environmental OLs and OLOs in Belgium, France, and Norway.

In all cases, the obstacles to pro-environmental action reflected egoistic and hedonic values. Egoistic values were related to the lack of ambitions of certain individuals or organizations, the importance of personal influence, and authority or social power that are used to justify climate inaction. Besides, egoistic values reflected the importance of financial resources necessary to act, which are 1) insufficient for individual action, 2) irresponsibly spent on the collective level, and 3) used as a goal to achieve, which may become an obstacle to CC mitigation for companies, for example.

Hedonic values reflected mainly the lack of comfort or pleasure for individuals, which may be related to the barriers to pro-environmental action. The percentages of each value item are summarized in Table 36. The percentage numbers reflect the relationship between the number of posts containing the value considering an obstacle and the number of posts considering food, energy, and transport themes by each type of enunciator in each country.

Table 36 Environmental values concerning the obstacles to CC mitigation, a comparative summary of the posts by environmental OLs and OLOs in Belgium, France, and Norway

Value cluster	Value item	Number of posts containing obstacles, in %					
		OL BE	OLO BE	OL FR	OLO FR	OL NO	OLO NO
Egoistic		14,61%	26,72%	6,70%	20,13%	19,39%	20,59%
	Successful	-	-	-	-	-	-
	Social recognition	-	-	-	-	1,02%	-
	Personal health	-	-	-	-	-	-
	Ambitious	0,46%	1,21%	0,72%	1,92%	-	1,47%
	Wealth	5,48%	8,50%	1,44%	8,95%	7,14%	7,35%
	Influential	0,46%	9,31%	0,96%	0,96%	-	1,47%
	Authority	4,57%	7,69%	2,39%	6,39%	7,14%	4,41%
	Social power	4,11%	4,05%	1,67%	3,51%	5,10%	7,35%
Hedonic		4,11%	1,21%	1,20%	5,11%	2,04%	-
	Inner harmony	2,28%	-	0,24%	-	-	-
	Satisfaction of accomplishment	-	-	-	-	-	-
	Comfort	1,37%	1,21%	0,72%	3,51%	2,04%	-
	Self-indulgent	-	0	-	-	-	-
	Enjoying life	0,46%	0	-	0,32%	-	-
	Pleasure	-	0	0,24%	1,60%	-	-
Number of posts analyzed, considering FET themes		219	247	418	313	98	68

Table 36 demonstrates the values concerning obstacles that appeared predominantly in the posts by organizations in the three countries. Although we identified several obstacles in the posts by the environmental OLs in France, in most cases, the environmental value concerning the obstacle was not identifiable.

The egoistic value cluster in relation to *authority* was mainly attributed to the obstacles in the posts by organizations that emphasized the authority of the governments and their leaders, which was not attributed to the right direction. The egoistic value cluster of *wealth* typically appeared in two cases: 1) when individuals emphasized the lack of money to contribute to a pro-environmental action and 2) when the money was attributed to controversial solutions. In Figure 80, we represented such Villain–Obstacle–Value relationship. The diagram on the left represents banks as villains whose actions, such as investing in fossil fuel companies, do not contribute to CC mitigation. The importance of financial profits for these companies is a key factor in relation to this obstacle, according to the environmental OLs and OLOs in the three

countries. This profit is connected to the egoistic value of wealth. A diagram on the right from Figure 80 illustrates governments and politicians as criticized for their irresponsible position towards regulating the climate crisis, particularly due to the signing of controversial policies, such as the green energy sources taxonomy, as discussed in the Belgian and French posts. Instead of using their authority to regulate sustainability policies, according to the environmental OLs and OLOs, governments and political leaders use their authority for controversial solutions (authority value item) and, in some cases, to gain profits (wealth value item).

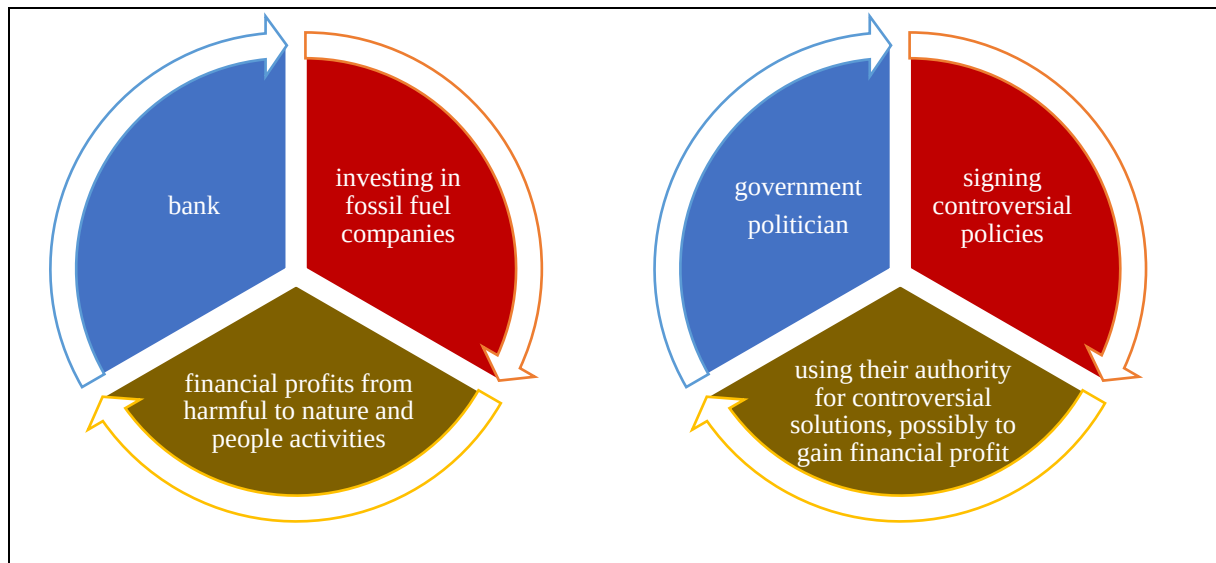


Figure 80 Examples of Villain-Obstacle-Value relationship

Hedonic values, such as comfort or enjoying food, were predominantly mentioned in the posts by environmental OLs in Belgium and Norway. They were mainly attributed to the food sector, which placed an emphasis on the displeasure of vegetarian food options. In the transport sector, the hedonic value of comfort was attributed to the inconvenience or lack of comfort during certain efforts to mitigate the effects of CC. Overall, the results considering hedonic values in our data correspond to the results in environmental psychology, where hedonic values are negatively related to pro-environmental attitudes and behaviors (Steg, Perlaviciute, et al., 2014).

To summarize, even though the three countries represent their particular cases in climate crisis regulation, which we discussed in Section 1.1 *Climate change and its mitigation*, and discuss different obstacles in the posts, the values concerning the obstacles are similar in the

three countries in our data. As in the environmental psychology studies by Bouman, Steg, and Kiers (2018), Bouman et al. (2020), Bouman et al. (2021), Birkenbash and Egloff (2024), the values identified in relation to the obstacles in the analyzed Instagram posts by environmental OLs and OLOs are related to the egoistic and hedonic value clusters. This partly confirms our

Hypothesis 1:

The obstacles to pro-environmental behavior in both posts and comments to them will be predominantly referred to the egoistic or hedonic values.

The obstacles and values in relation to them appearing in the comments were evaluated by mixed-method case studies presented in Chapter 7 Mixed-method case studies.

6.4.2 Reflecting on the Instagram data analysis

Analyzing Instagram posts is a complex process that may address different questions: the content posted under specific hashtags or within specific accounts, self-presentation, and individual or organizational communication. These are just several examples of data from Instagram addressed in communication research, which is not limited to a particular subject. In this work, we drew particular attention to the **content** shared by different individual and organizational accounts of environmental OLs. It should be noted that the focus of the research was the **posts' content itself**, not the identity of the environmental OLs and OLOs. Although, in some examples, we specified the type of account for an analyzed post, i.e., politician, activist, or creative professional, we did it to provide the contextual information in all cases since it was not the study's primary aim.

In part 4.3.2 *Multimodal content analysis: codebook and procedure*, we proposed a complex analysis procedure that covered four important thematic categories reflecting our contributory research questions: CC themes, actions and actors, obstacles, and values. This work extends most studies on framing CC debates on social media by providing a comparative study of three countries: Belgium, France, and Norway. Although many studies in environmental communication addressed multiple countries (Jang & Hart, 2015; Kleinen-von Königslöw et al., 2019; Shehata & Hopmann, 2012; Wozniak et al., 2015), they were primarily focused on one type of enunciator, or one thematic category and used smaller datasets for content analysis. Compared to them, we addressed three thematic categories communicated by 70 environmental OLs and 50 environmental OLOs.

The complexity of the analysis process is particularly linked to the data selection, sorting, and analysis. For example, at the data collection stage, we obtained 13047 posts by environmental OLs in Belgium, France, and Norway (cf. Section 4.2.2.2 *Collected corpus of Instagram posts*). Among these posts, 5459 posts considered our selected timeframe: 1 January 2021 – 31 March 2022. This *Corpus21-22* was further automatically labeled according to the three topics: food, energy, and transport, and included 1123 posts. This corpus was further reduced during the multimodal content analysis process to 971 posts since some posts about our focus themes did not discuss CC or environment-related themes. This process of data reduction for multimodal content analysis is represented in Figure 81.

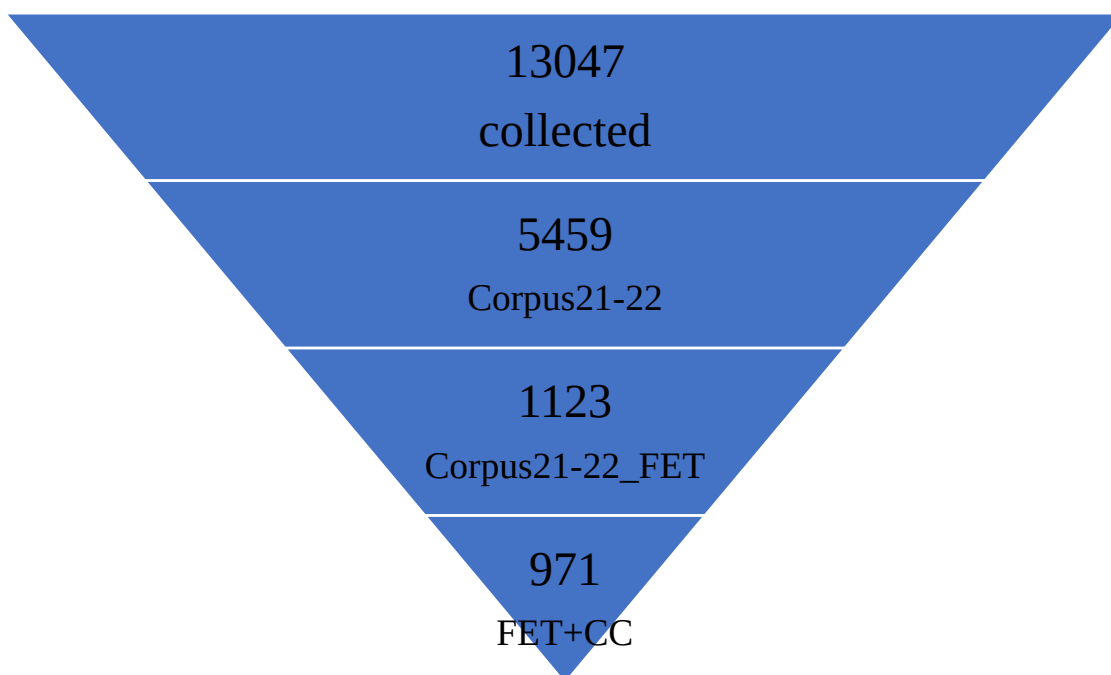


Figure 81 Data selection for multimodal content analysis, an example of posts by environmental OLs considering food, energy, and transport themes in relation to CC mitigation in 2021-2022

After a detailed examination of the posts considering the food, energy, and transport sectors (*Corpus21-22_FET*), we identified several important issues that should be addressed: the intermediality of the posts, the role of different modes of communication on Instagram, and narrativity of Instagram posts.

Broadly speaking, intermediality can be defined as interconnectedness between different media sources, i.e., when different media refer to and depend on each other and interact with each other by using different communication strategies (K. B. Jensen, 2016). In our corpus,

we observed a high level of interconnectedness between Instagram and other media sources. Since an Instagram post is limited to 2200 characters, publishing longer, argumentative texts such as media articles can be complicated. In this case, the environmental OLs and OLOs frequently provided links to other sources of information in their posts. These sources included media websites, media pages on Instagram, websites of environmental organizations and social movements, websites of bookshops or cinemas, links to governmental reports, and links to posts or accounts on different social media, such as Instagram, YouTube, Facebook, or TikTok. In some cases, the environmental OLs and OLOs used screenshots from media articles or websites to provide commentaries on them. This relationship between Instagram and other digital platforms is multimodal and complex: multimodal – because the connections with other media sources were specified in different modes (screenshots, reposts, links in the texts), complex – because it involves multiple platforms and demands contextual knowledge in particular cases.

Several studies attempted to address intermediality by investigating the intermedia nature of GIFs (S. K. Jensen et al., 2021) or by comparing communication about CC on different social media (Al-Rawi et al., 2022; Lubicz et al., 2023; Pearce et al., 2020). These studies focused on the differences in environmental communication on different platforms, such as Instagram, Twitter, Facebook, and YouTube. However, no studies addressed intermediality as the relationship between the links appearing in different modes within one media and directing the readers to another media. We suppose that these intermediate interactions can influence the communication between the environmental OLs and OLOs and their audiences on some level. It is possible that the links to credible media sources can enhance the level of confidence in the OLs and OLOs and motivate interactions with them. In turn, controversial or doubtful sources of information might negatively influence the reputation of the OLs and OLOs among their audiences. Overall, this intermediality appearing in the posts of environmental OLs and OLOs opens new perspectives in communication and media studies.

Another aspect of intermediality can lie in the adaptation of different forms of communication from one media to another. With the development of Reels – short vertical videos up to 60 seconds in 2020 and 2021 – some marketing specialists identified this content format as quite similar to TikTok videos (short videos up to 10 minutes). In particular, the functions of Instagram Reels and TikTok videos differ in terms of the video editing process (Mileva, 2023). In our data, we observed multiple Instagram Reels, posted in particular by environmental OLs, with similar formats to TikTok: short videos using dynamic music and

attractive humorous content. The environmental OLs more frequently use the “POV” narrative structure, which means “point of view.” The “POV” narratives were used to create relatable or immersive content, where OLs simulated a specific scenario, imagining themselves in that situation. These narratives contributed to the establishment of an emotional connection with the viewers. The same structure of videos is frequently used in TikTok videos.

Regarding multimodality, Instagram is a multimodal platform where people can share their thoughts in different visual and verbal modes: the users combine still and moving images, including or without texts or audio, and accompany these visuals with the verbal mode of caption, yet including some visual elements as emojis as well. In the case of environmental OLs and OLOs in Belgium, France, and Norway, we observed multiple combinations of different modes within posts: different types of images accompanied by short or long texts within the image itself or within the captions, short humorous videos, including dynamic music, long video reportages or interviews subtitled for viewers’ convenience and accompanied by brief descriptions, long post’s texts accompanied by photos from manifestations as illustrations to the texts, and other. In their recent study, Qian et al. (2024) demonstrated a relatively small percentage of images considering activism and data visualization, such as graphs, charts, or maps. In our data, on the contrary, the images of climate activism and data visualizations were largely present, particularly in the posts by the environmental OLOs. Yet, Quian et al.(2024) analyzed hashtag-based data and did not compare the appearances of these visuals within different types of accounts.

Although Instagram is frequently considered an image-based social media (Pearce et al., 2019), where visual content plays a vital role, in our data, significant attention to the environmental OLs and OLOs in the three countries has been paid to a major verbal element of the post – its caption. The captions provided contextual information to the visual elements, without which it would be impossible to address our research questions. In the majority of the posts, the responses to our Codebook questions (Appendix 4 *Multimodal content analysis codebook*) were predominantly identified in the verbal mode: the captions to the posts or the texts within images or videos.

Environmental OLs and OLOs used different types of visual content to communicate about CC and sustainability-related issues: illustrations, ethos images, knowledge images, referential narratives, and spectacular images, as defined by Catellani (2018). Illustrations were more frequently represented by photos from protesting actions or political meetings. Close to

illustrations since they visualized the captions, referential narrative images were mainly represented by video narratives explaining specific climate actions or providing personal examples. Ethos images illustrating the OLs were used as illustrations of what had been said in the posts' texts. Spectacular images included different humorous and memetic structures. Knowledge images referred to infographics, which were especially adopted by organizational discourses explaining CC causes, impacts, and possible solutions.

Besides single-posted referential narratives by environmental OLs and OLOs, we observed different types of storytelling in the analyzed data, which were generally utilized by individuals in our corpus – the narratives or storytelling within an account. While a set of posted images or videos can contain a story within it, another story can be demonstrated by several posts. This can be referred to as Instagram's narrative capabilities, as Kozharinova and Manovich (2024) suggested. These narrative capabilities include real settings that can be described as “‘broadcast’ from a series of real-world locales, whose familiarity can assist the viewer place themselves within the blog's chronotope” (Kozharinova & Manovich, 2024, p. 29). Specifically, in our data, we observed a series of posts on a common central theme which can be included in a single storyline of personal experiences regarding pro-environmental actions on an individual or group level. A series of posts by @youth.for.climate and @youthforclimatefr narrated civil protesting actions within multiple posts: they introduced posters inviting to participate in the action, provided illustrations of protesting actions in different towns and cities, and recapitulated the results from this activity. Another example of Instagram as a narrative space can be illustrated by a series of posts by Greenpeace in France under the #presidentielle2022 hashtag, which discussed different efforts directed at CC mitigation in relation to the presidential elections' campaigns. In the present work, we did not focus specifically on the narrative components and the structure of storytelling, yet we believe that the narrative side of environmental communication on Instagram should be better analyzed by future studies.

Chapter 6: Key elements

Cross-country observations

- The food sector achieved the highest attention in the posts by environmental OLs and OLOs, except the environmental OLOs in Belgium, who tended to post about the energy sector.

- Politicians in Belgium, France, and Norway tended to discuss transport- and energy-related themes.
- People pursuing creative professions in the three countries predominantly discussed the sustainability transition in the food sector.
- The majority of posts were solution-oriented.
- The French and Norwegian environmental OLs discussed mainly following vegetarian diets or reducing meat consumption. The French OLs also highlighted the consumption of local organic meat as a solution to CC mitigation.
- In all countries, fossil fuels were frequently opposed to renewable energies in the posts.
- Nuclear energy was mainly present in the French and Belgian subcorpora.
- The French subcorpora were more specific about the transport solutions, including the description of co-driving, car-sharing, or collaborating with Google Maps.
- In all countries, most individual actions were concrete solutions, while the group actions were ambiguously deliberated.
- In all countries, environmental OLs more frequently emphasized individual actors responsible for CC mitigation, while the OLOs highlighted the role of collective action.
- The role of the EU in regulating the climate crisis was particularly mentioned in Belgium.
- The posts by organizations in the three countries implied more critical opinions and discussed more frequently the actors responsible for inaction, who were mainly the governments, companies, and politicians.
- All obstacles can be divided into two categories: individual-level obstacles (health, feelings, money, stereotypes) and collective-level obstacles (actions of governments and companies). Transversal obstacles include organizing the action and communication and knowledge.
- Several emojis were observed as markers of obstacle discourse in the three countries: 😞, 🤔, 😔, 🙌.
- In all countries, biospheric values appeared the most frequently in the posts. The egoistic and hedonic values were linked to the obstacles.

Observations of Instagram data analysis

- Although posting visuals, i.e., images or videos, is a predominant characteristic of Instagram, our study demonstrated the essential role of text in identifying obstacles and environmental values. Without the textual component, it would be impossible to identify the obstacles in the posts.
- The role of intermediality in environmental discourse is essential. Links to other platforms or websites provide more contextualized information about climate issues. Such links connecting Instagram posts and other platforms were used as mobilization tools by environmental NGOs and movements, who frequently asked their audiences to sign petitions under specific links.
- Instagram Reels about CC-related issues use a format similar to TikTok videos, i.e., short, engaging videos with dynamic music and somewhat humorous content.
- Although Instagram is mainly visual social media, the role of text in communicating about CC is undeniable.
- The OLs and OLOs used different types of content, such as illustrations, referential narratives, ethos images, or knowledge images (Catellani, 2018).
- The storytelling in environmental communication is developed within a single post and within a storyline discussed in multiple posts and demands further investigation.
- Emojis are largely present in environmental discourses on Instagram and merit further investigation.

Chapter 7 Mixed-method case studies

The mixed-method studies represent a complex approach to understand how OLs and OLOs communicated about the obstacles to pro-environmental actions and the values in relation to them. In particular, we are interested in investigating visual and verbal patterns and tendencies that appear within the Instagram posts containing obstacles and in the comments to them. Each case study shall be seen as a separate work, which can be further published as an academic article.

For mixed-method analyses of our data, we manually selected four subcorpora of the posts and the comments. The principal criterion for the selection was the appearance of obstacles in the Instagram posts regarding the sustainability transition in the food, energy, and transport sectors, which were communicated by different environmental OLs and OLOs in Belgium, France, and Norway. The obstacles we used to select the data for case studies resulted from multimodal content analysis discussed in Chapter 6. Since the Norwegian data is underrepresented in *Corpus21-22*, we focus on specific data considering French and Belgian posts in this Chapter. We did not take into account all topics in all countries due to the limited number of posts, obstacles in several subcorpora, and time restrictions.

The mixed-method analysis of the selected data comprised a qualitative multimodal discourse analysis combined with computer-assisted linguistic observations of the posts, sentiment analysis, content analysis, and computer-assisted linguistic analysis of the comments.

In the food sector, we analyzed the ensemble of the posts by the environmental OLs and OLOs in France regarding **reducing meat consumption** and **following vegetarian diets**. The data, analyses' results, and reflections are discussed in Section 7.1 *Case study 1: Communicating about reducing meat and vegetarian lifestyles in France*.

In the transport sector, we investigated the posts by the environmental OLs from France regarding **the use of public transport instead of individual cars**. We present the data, analyses results, and reflections on them in Section 7.2 *Case study 2: Communicating about sustainability transition in the transport sector in France*.

In the energy sector, we analyzed two subcorpora regarding **the transition from fossil fuels to renewable energies**. First, we discuss the mixed-method case study from the posts by Belgian environmental OLs and OLOs in Section 7.3. The second case study concerning the energy sector is focused on the posts by French environmental OLs and OLOs. We elaborate on the data, analyses' results, and reflect on them in Section 7.4.

Section 7.5 *Reflecting on the mixed-method case studies* represents a commentary on the observed obstacles, values, and narrative roles in the case studies.

7.1 Case study 1: Communicating about reducing meat and vegetarian lifestyles in France

This case study investigates the communication about the food sustainability transition by environmental OLs and OLOs in France since this subcorpus included the highest number of posts containing obstacles to pro-environmental behavior considering the food sector. First, we introduce the data from the case study. Second, we provide the results from multimodal discourse analysis of the posts complemented by computer-assisted linguistic observations. Third, to extend the analysis of the posts, we conducted sentiment and content analyses of the comments complemented by computer-assisted linguistic analysis, which are discussed in parts 7.2.3–7.2.4. We conclude the case study by reflecting on the results.

7.1.1 Selected data

To investigate the communication about the sustainability transition in the food sphere in France, we selected the posts by OLs and OLOs from the *Corpus21-22_FET* obtained from an automated content analysis (cf. Section 4.3.1 *Automated content analysis*) and multimodal content analysis (cf. Section 6.2 *France*). These posts discussed following vegetarian diets or reducing meat consumption as solutions to CC mitigation since the obstacles to pro-environmental action were largely discussed in the posts considering these actions. In this part, we report on the selected data.

Overall, we selected 39 posts by environmental OLs and OLOs in France, which included 75 media files: 66 images and 9 videos. The organizations tended to post more still images in one post, with the mean number of images per post being 2,06 compared to 1,43 images by the individuals. These statistics are illustrated in Table 37.

Table 37 *Corpus of posts regarding the food transition by environmental OLs and OLOs in France*

	Posts analyzed	Number of images	Number of videos	Mean number of images per post	Mean number of videos per post
OL_FR	23	33	6	1,43	0,26
OLO_FR	16	33	3	2,06	0,19
Total	39	66	9	1,64	0,23

In general, individuals and organizations posted predominantly images as media content: images are present in 73,91% of the posts by individuals and 81,25% by organizations. While organizations tended to post more images within their posts, the individuals shared more video content than organizations (Table 37). The highest number of posted images within one post by the organizations is ten from a post by @wwffrance, and by the individuals is eight, by @graine_de_possible. As a rule, the posts by individuals and organizations either included images or videos: No posts combined images and videos.

During the data collection stage, we also obtained 1261 comments to the selected posts that considered meat and vegetable consumption by environmental OLOs and OLs in France. Before analyzing the comments, we cleaned the data by deleting mentions and links to other resources that do not possess any emotional function. We also deleted the duplicate comments posted by the same person to the same post. Overall, we obtained 1164 clean comments for the sentiment analysis, with a high prevalence of comments on the posts by individuals (Table 38). After conducting content analysis, we discovered that only 10% of the comments contained obstacles within them (Table 38). The detailed content analysis results are further discussed in Section 7.1.4 *Analyses of the comments*.

Table 38 Comments data to the posts about food transition by French OLs and OLOs

Type of account	Comments collected	Comments cleaned	Comments with obstacles
OL	927	866	64 (7,39% from cleaned)
OLO	334	298	57 (19,13% from cleaned)
Total	1261	1164	121 (10,40% from cleaned)

The analysis procedures are detailed in Section 4.3.3 *Case studies' analyses: a mixed-method approach*. In the following parts, we outline the results from mixed-method analyses.

7.1.2 Multimodal discourse analysis of the posts

To investigate the representation of the obstacles, values in relation to them, and narrative roles concerning food sustainability in France, we conducted a multimodal discourse analysis of 39 selected posts by French environmental OLs and OLOs. The analysis grid and detailed procedure are provided in Section 4.3.3.1 *Multimodal discourse analysis of selected posts*. In the following paragraphs, we discuss the analysis results following the analysis grid. First, we

discuss iconic signs. Second, we delineate plastic signs. Third, we highlight the linguistic signs. A computer-assisted linguistic analysis with *Sketch Engine* complements the analysis of linguistic signs.

To start with, the posts by French OLs and OLOs discussed vegetarian diets more frequently than reducing meat consumption. In their Instagram posts, OLs communicated mainly about their personal experiences of following vegetarian diets by providing food recipes or tips for adopting vegetarian or vegan lifestyles. In several posts, the OLs blamed other people for their “anti-vegan” positions. Other themes discussed by environmental OLs included advertisements of local or organic vegetable producers and interviews with other people about their vegetarian lifestyle experiences. The organizational discourse was mainly focused on providing information about meat consumption or following vegetarian diets, discussing the adoption of vegetarian food menus in school canteens, and campaigning against lobbies in the agriculture sector. Individuals and organizations attempted to engage their audiences in climate action, such as following vegetarian diets or reducing meat consumption. By the audiences here, we understand the people commenting on the selected posts.

Regarding the **iconic signs**, i.e., what is represented in the post and what it signifies, the OLs and OLOs posted many images of people, showing personal examples of contributing to climate action, such as choosing a vegetarian menu or supporting a text with a personal photo. Indeed, we identified human figures in 16 images and nine videos, i.e., one-third of all analyzed visuals. These human figures were represented by the OLs’ photos of real people, graphic representations of humans, and fictional characters, such as the main characters from the TV series *Friends*. In fact, these characters were used as a memetic or humorous form to discuss three arguments to reduce meat consumption. These arguments included the connection of meat production with the emissions from the food sector (image 1, Figure 82), overconsumption of animal proteins (image 2, Figure 82), and the price of meat (image 3, Figure 82).



Figure 82 Extracts from a post by @reseuactionclimat, 28.12.2021

Human figures in the analyzed posts were typically represented as enjoying life's pleasures, such as being in nature, eating, or spending time with friends, which can be linked to hedonic values.

Despite being the main subject of the analyzed posts, the food elements appeared not frequently in the visuals: only in 20% of the visuals. We identified 14 images and one video of food, including the images of raw ingredients and cooked dishes. In most of these images, food was accompanied by the hedonic value item of enjoying life, as shown in Figure 83.



Figure 83 Image from a post by @onestpret, 20.04.2021

Different elements related to nature appeared in several posts by environmental OLs and OLOs. They included images of glaciers, the globe, landscapes, flowers, forests, and animals. The animals were illustrated in one video and four images, mainly represented by chicks and cows.

In this subcorpus, the iconic signs did not generally represent the obstacles to pro-environmental action. We identified a few iconic elements in relation to the obstacles considering reducing meat consumption: fire, muscles, cow, beef, and a man eating a burger. As a rule, the obstacles in the iconic elements appeared in the posts by environmental OLOs. These obstacles were related to the actions of companies such as meat industries or “*lobbies de la viande*.” According to the OLs, these companies manipulate people’s decisions by using greenwashing communication strategies, providing misleading information about meat consumption, or influencing medical industries by spreading informational brochures promoting meat consumption.

A post by @ecotalkfrance from Figure 84 shows a person doing a barbecue titled “Comment les lobbies de la viande nous manipulent.” Although the obstacle to CC mitigation considering meat consumption is described in detail in the text of the post and the text from the visuals, the image of fire can be related to potential danger from the activities of meat industries. Nevertheless, without the title on the black background, this visual can also illustrate the hedonic value of enjoying food.



Figure 84 Post by @ecotalkfrance, 12.03.2022

Another example of a visual representation of obstacles was observed in a post by @greenpeacefrance. Figure 85 represents a rhetorically constructed image of a citizen as a victim of stereotypes communicated by meat industries.



Figure 85 Post by @greenpeacefrance, 07.12.2021

In the post from Figure 85, the NGO used visual metaphors to talk about obstacles related to stereotypical opinions considering meat consumption. Specifically, the person from the image can be compared to an image of a cut of pork, where each part represents a pig's part, as on the left part of Figure 86. In addition, the image can be compared to a humorous representation of paintings by Western artists. As an illustration, we provide an image of the picture *A Young Bachus* by Sir Martin Archer Shee on the right side of Figure 86. In addition to these visual metaphors, Greenpeace used red and yellow colors (plastic signs) in the post from Figure 85, which can be associated with the colors of a fast-food company *McDonald's*, frequently criticized by the NGO for greenwashing.

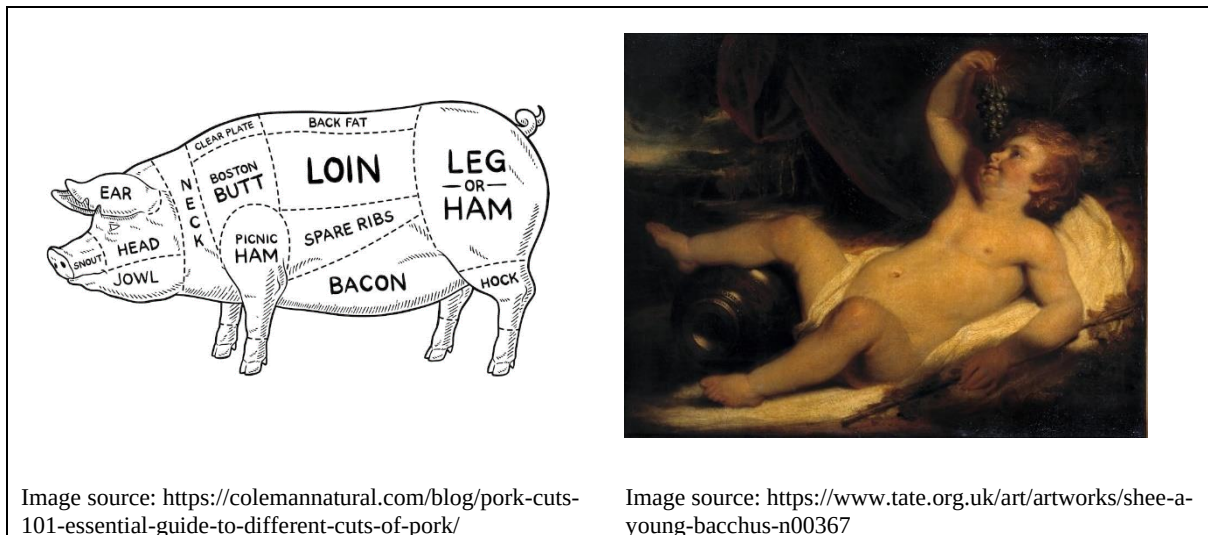


Figure 86 Associations with the post by @greenpeacefrance

We identified different narrative roles in visuals to complement the observation of obstacles. The heroes, i.e., the actors contributing to CC mitigation, were represented by images of people, doctors recommending reducing meat consumption, and farmers. The villains identified in the iconic signs were meat, people eating meat, and meat lobbies. The images of the meat were identified as obstacles in the iconic signs because they were accompanied by a text (linguistic sign) saying that they were harmful to the planet and people and by frequent use of red and dark colors on the background (plastic sign), which could emphasize the meaning of the iconic sign. Pictures of the globe or the planet, children, forests, and animals such as chicks represented victims.

The environmental values in the visual mode were represented by biospheric, altruistic, egoistic, and hedonic value clusters. The images of farm animals, landscapes, the globe, forests on fire, and glaciers pictured biospheric values. Altruistic values were pictured mainly by groups of people hurrying to climate protesting action. While egoistic values were not represented in visuals, hedonic values were largely present and illustrated by food images.

According to our analysis grid, we observed different compositions and colors in the analyzed **plastic signs** of the visuals. The analyzed visuals demonstrated dark colors like black, brown, and dark green (bottom line images and top right corner, Figure 87). Green and blue colors, often associated with nature, were frequently adopted by the OLs and OLOs, particularly as background colors for specific information. In several visuals, white and beige were used as

a background for the textual information or infographics. We illustrated the analyzed images in Figure 87, where the visuals are sorted according to their colors with the help of *ImageSorter*.

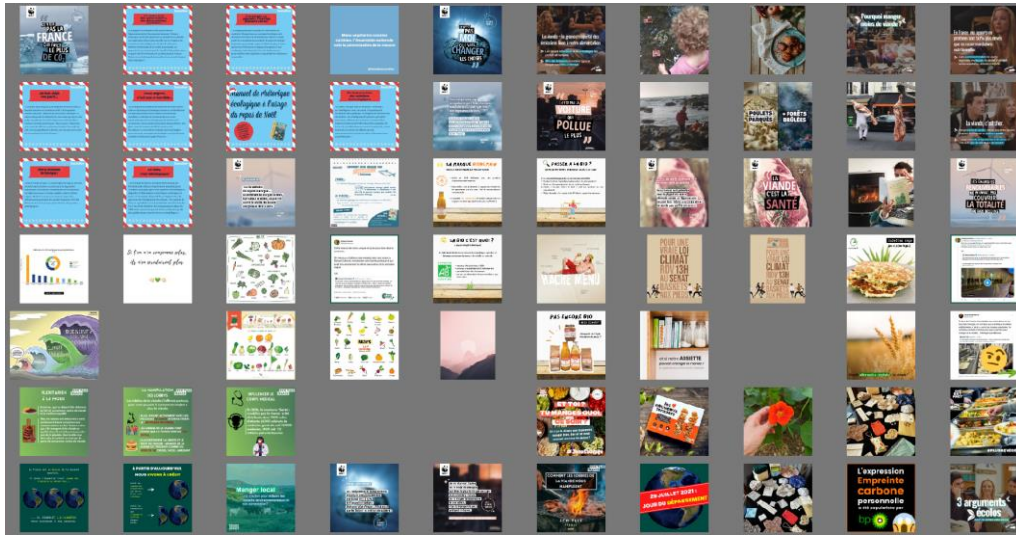


Figure 87 Visualization of 66 analyzed images from the corpus data, done with the ImageSorter V4

In addition, Figure 87 demonstrates multiple images containing verbal elements. The verbal component of the image took a central position in most images, contrasting with the picture or color on the background (Figure 87). Black and red colors are frequently associated with obstacles in the images; however, they are not frequently used by environmental OLs and OLOs in this subcorpus. The red-orange color of the barbeque fire illustrated the danger considering the actions of meat lobbies (Figure 84). Black was represented in three images as a background for the text, emphasizing the negative role of companies in CC mitigation. In a set of images posted by @camilletienne_, black text on a red background illustrated stereotypical phrases sometimes related to misinformation about CC and its mitigation; these phrases are demonstrated in Figure 88. While extracts 1, 2, or 4 from Figure 88 demonstrate personal opinions, extract 3 is closely related to misinformation about the IPCC, *GIEC* in French, a group of experts working on the evolution of climate-related issues.



Figure 88 Extracts from a post by @camilleetienne_, 20.12.2021

Considering the **linguistic signs** of the analyzed posts, the images and videos were generally accompanied by the text within them. 89% of the media files (56 images and 8 videos) included verbal elements. The verbal elements in videos were generally represented by the subtitles. Most dark-colored images included white text, and light-colored backgrounds incorporated dark texts. This technique allowed the readers to focus on the verbal part of the visual element. The text took a central position within the image. In many posts, the title was written in a larger font than other text on the image to announce the discussed theme. In addition to large titles, some words were highlighted in different colors, such as red, orange, yellow, or blue, within the text on the image. This interplay of colors and the specific highlight of words were aimed to gain audiences' attention to the provided information, i.e., the solutions or the obstacles.

In the analyzed posts concerning the food sector, environmental OLs and OLOs discussed the adoption of vegetarian diets and reducing meat consumption. Interestingly, these two actions to the sustainability transition in the food sector were frequently used in opposition. Indeed, the posts discussed reducing meat consumption and following plant-based diets. The most frequently used verbs with the noun *végétarien* were *cuisiner*, *devenir*, *être*, *suivre*, *déclarer*, and *soutenir*. The verbs used in combination with the noun *viande* included *passer*, *réduire*, *aimer*, *remplacer*, *choisir*. We illustrate these differences in the use of the nouns *végétarien* and *viande* in Figure 89 below. The colors attributed to each word are generated automatically by *Sketch Engine*. However, we observed that the word *végétarien* typically had a positive connotation in the analyzed posts, while the noun *viande* had a negative connotation.



Figure 89 Word Sketch difference between “végétarien” and “viande” in the posts by environmental OLs and OLOs in France, made with Sketch Engine

The environmental OLs and OLOs used thematic hashtags as keywords for their posts, including #viande, #elevageindustriel, #environment, #nature, #cantines, #loiclimat, #vegetarien, #veggie, #veggiefood, #vegetal. These hashtags were oriented to solutions, i.e., following vegetarian diets, the biospheric value of nature protection, and attribution of blame to different collective actors, such as school canteens or farming industries. A post by @ecotalkfrance, illustrated in Figure 84, demonstrates the use of hashtags. They used a set of hashtags – #viande, #lobby, #lobbies, #boeuf, #porc, #manipulation, #proteine, #flexitarien, #influenceur, #médecin, #ecologie, #sauvonslaplanete, #agir – to highlight the role of meat and meat lobbies in on the sustainability transition in the food sector. In the end, they appealed for collective action to save the planet.

The obstacles to CC mitigation and the related values in the posts by French environmental OLs and OLOs concerning meat and vegetable consumption were introduced preliminary in the verbal mode of all posts: the caption to the post and the text appearing in the image or video. The identified obstacles in the posts can be divided into several categories: 1) *Actions of companies or industries*, 2) *State authorities’ (in)action*, 3) *Organization of the action*, 4) *Personal feelings and conditions*, 5) *Actions of other laypeople*, 6) *Communication and knowledge*, and 7) *Stereotypes*. In the following paragraphs, we provide examples of each obstacle and link the obstacles to environmental values where possible.

Actions of companies or industries were seen as obstacles by both individuals and organizations. They can be described as actions that are harmful to nature or humanity and are conducted by different companies or organizations. These companies can be supermarkets or meat lobbies (“*les lobbies de la viande*”).

1: “🛒 Dans les rayons de son magasin, **difficile parfois de savoir quel est le choix le plus écologique...**[...]” (post by @consommons.sainement, 18.05.2021).

2: “[...] les lobbies de la viande, qui font de leur mieux pour s’infiltrer partout et nous convaincre de ne pas réduire notre consommation [...]” (post by @wdEjOy, 28.01.2022).

3: “[...] **les lobbies de la viande** s’infilrent partout, pour **nous pousser à consommer toujours plus de viande** [...]” (post by @ecotalkfrance, 12.03.2022).

Example 1 above highlights that the supermarkets do not adapt their communication about sustainable food. This example can also be related to the obstacle category *Organizing the action*, yet with a particular emphasis on the responsible actors. Besides, example 1 can be linked to the hedonic value of comfort: when the situation is uncomfortable for consumers. Examples 2–3 illustrate the meat lobbies as villains whose actions do not contribute to CC mitigation. These obstacles can be related to the egoistic value item of social power, which is not used by these entities to move towards a sustainability transition.

The *State authorities’ (in)action* was attributed to the government’s insufficient efforts toward sustainability transition in the food sector or the government’s attribution of responsibility for pro-environmental actions on individuals, as in example 4 below. This obstacle can be related to the egoistic value item of authority, which the government does not use to tackle the climate crisis.

4: “[...] En revanche, il est vain de prétendre résoudre la question climatique en faisant **reposer l’exclusivité de l’action sur les seuls individus**. Le problème est systémique ; la construction d’une solution viable et crédible ne peut donc faire l’économie d’une action collective forte [...]” (post by @lesbellesnouvelles, 05.02.2021)

The obstacle category *Organization of the action* was attributed to the difficulties appearing during the adoption of reducing meat consumption. For instance, example 5 below attributes poor organization of vegetarian food menus to school canteens. Following a vegetarian diet may also be uncomfortable if a person wants to have vegetarian food home-delivered since the

options are not extensive (example 6). This obstacle category referred mainly to the hedonic value item of comfort or enjoying life's pleasures, such as food.

5: “[...] Dommage donc de ne pas pouvoir leur proposer une option végété convenable quotidiennement [...]” (post by @onestpret, 20.04.2021).

6: “**Mais** on sait que ce **n’est pas toujours évident**, surtout lorsqu’on veut se faire plaisir avec un repas livré chez soi par exemple.” (post by @onestpret, 15.10.2021).

Personal feelings and conditions as an obstacle category referred to individuals' personal reasons for demotivating them to reduce meat consumption or implement vegetarian menus in their everyday lives. These constraints can be economical, social, or practical – as demonstrated by example 7 – and can be associated with the egoistic value item of wealth or the hedonic value item of comfort. Besides, personal conditions of not knowing how to adopt vegetarian menus (may also be related to communication and knowledge obstacles) and being worried about having an iron deficiency can also be significant reasons for not preparing vegetarian food. Example 8 demonstrates the connection between egoistic value item of personal health and this category of obstacles.

7: “[...] ou bien parce que **cela représente trop de contraintes (économiques/sociales/pratiques)** ? 😊 Il se peut aussi que pour le moment tout cela, cette « transition », soit très flou pour toi et que tu avances à tâtons ? [...]” (post by @ecoyako, 02.03.2022).

8: “[...] Tu souhaites adopter un régime végétarien **mais tu ne sais pas/plus trop quoi cuisiner** ? / Tu tournes en rond dans tes recettes ? / Tu as peur d’avoir des carences (protéines, B12, oméga 3...), tu ne connais pas exactement les différentes alternatives aux protéines animales ? [...]” (post by @lesnazerodechet, 25.03.2022).

Actions of other laypeople may demotivate a person's desire to act for climate and can be related to the egoistic value item of influence, as shown in example 9 below. Example 9 states that the opinions of someone's friends can be demotivating in adopting a vegetarian diet.

9: “Vous voulez un réveillon #végétarien **mais vos amis ne sont pas du même avis** ?” (post by @reseauactionclimat, 28.12.2021)

Communication and knowledge-related obstacles referred to the amount of information about CC issues and the adoption of vegetarian menus, which can be controversial and, therefore, confuse citizens and demotivate them to follow pro-environmental actions. Example 10

illustrates that it can be difficult to distinguish between correct and fake information concerning reducing meat consumption, eating local food, or even energy transition.

10: “La viande, le bio, l’énergie... Beaucoup d’idées reçues fusent à table, et **vous avez du mal à démêler le vrai du faux ?** En plus les Présidentielles approchent, et les débats sont de plus en plus salés 😬” (from a post by @wwwffrance, 21.12.2023)

The majority of the posts presented one obstacle to CC mitigation. However, some posts combined the discussion of two obstacles, which were logically linked, as we saw in the examples above. Another example of a combination of obstacles within one post can be a post by @greenpeacefrance from Figure 85, where stereotypes are illustrated in the verbal part of the image. These *Stereotyping opinions* distributed by *Companies* producing meat included the description of meat as 1) liberty, 2) food for real men, 3) traditionally served by women, 4) patriotic, 5) ecological, 6) pleasant moment, 7) good for health. Such stereotypes can be seen as a specific category of communication and knowledge-related obstacles.

At the stage of the qualitative analysis, we noticed that obstacles were sometimes introduced in the texts containing the conjunction “mais.” We applied the *Sketch Engine* Concordance function to illustrate all sentences, including “mais.” The conjunction “mais” was used in relation to the obstacles 11 times.

Details	Left context	KWIC	Right context
1  ient j'ai changé les choses Tu souhaites adopter un régime végétarien	mais	tu ne sais pas/plus trop quoi cuisiner ?</s><s>Tu tournes en rond dan	
2   et bio l</s><s>~ Les avantages du bio sont décrits dans le visuel	mais	comme pour un.e agriculteur.rice la conversion en bio est longue, il fai	
3  é bien réfléchie et que je n'ai plus jamais questionné ensuite.</s> <s>	Mais	je sais que nous n'avons pas tous les mêmes prises de conscience au	
4  iement #bienveillance 🙌 ~ Si vous avez envie de réduire votre conso	mais	ne savez pas trop par où commencer, peut-être que le lundi vert est ur	
5  et du fromage 🧀) et alors une des personnes à table me demande «	mais	tu n'as pas de carences ? » (celle-là on la connaît) et plus tard « ça ne	
6  ans pour autant être dans l'extrémisme.</s><s>Nous faisons attention	mais	ne nous empêchons pas de vivre non plus.</s><s>Nous essayons de	
7  vivre non plus.</s><s>Nous essayons de sensibiliser notre entourage	mais	ne sommes pas devenus des tirans Zd aux réflexions blessantes et a	
8  n réalité à réduire sensiblement sa consommation de viande.</s> <s>	Mais	les lobbies essaient de faire croire qu'il est inutile de réduire la viande.	
9  la viande.</s><s>Nous savons que c'est faux.</s><s>Il faut réduire –	mais	bien sûr, tout en soutenant l'élevage paysan, qui crée des emplois et p	
10  l'occasion et encore l'occasion, moins de bagnole et du troc.</s> <s>	Mais	ça va toujours pas, j'ai la sensation de me trouver des excuses.</s><s>	
11  us 🍷 bit.ly/kkbb-zone-sauvage Vous voulez un réveillon #végétarien	mais	vos amis ne sont pas du même avis ?</s><s>Tous nos conseils en im	

Figure 90 Use in the context of the “mais” in the posts by environmental OLs and OLOs in France considering food theme, made with the Concordance function in Sketch Engine

In Figure 90, lines 1, 4, 6, 7, and 10 represent obstacles related to *Personal feelings and conditions*, such as not knowing which plant-based dishes to cook or how to cook them, different impeding feelings, and finding excuses not to reduce meat consumption. Lines 2 and

9 in Figure 90 reflect obstacles concerning the *Organization of the action*, such as difficulties related to the transition within the agriculture sector or reducing meat consumption while supporting local meat producers, which may be controversial. The *Actions of other people* in Figure 90 demonstrate the unwillingness of other people to act (line 3) or the social judgment or influence by other people, which may demotivate other people (lines 5 and 11). Finally, line 8 in Figure 90 reflects the obstacles regarding the *Actions of meat industries*.

The narrative roles of heroes observed in the posts' captions (linguistic signs) included different responsibilities attributed to individual or group actors. The individual actors were represented by "myself" (the author of a post), "you" (the reader of a post), people changing their consumption habits, and everybody in general. Collective actors comprised a person's family, an unidentified group entity "on," and organizations. In the texts, the villains criticized for their irresponsible position towards CC mitigation were politicians, such as President Macron or Valérie Pécresse, "*anti-écologues*" or people criticizing environmental activists, family, rich people, climate extremists, and friends of the posts' authors. The group entities of villains were represented in the linguistic signs by meat lobbies, fossil fuel and other companies, the meat industry, and France. The environmental OLs and OLOs also attributed the role of villains to things or concepts, such as meat or habits of an individual. The victims in the posts were represented by children, agriculture workers, organic food shops, "us" or all people, and people from the poor and lower middle classes. The nature-related victims were illustrated by biodiversity, nature, planet, environment, trees, and animals.

To summarize, in this part, we provided the results from a multimodal discourse analysis of 39 posts about reducing meat consumption and adopting vegetarian diets discussed by environmental OLs and OLOs in France from January 2021–March 2022. Our objective was to analyze the content itself, not the self-representation of different enunciators. We focused on iconic, plastic, and linguistic signs to identify the obstacles, values, and narrative roles in the posts. These signs were intertwined in the analyzed posts. Identifying the obstacles, values, and narrative roles in the visuals could be complicated without the provided verbal explanation. This verbal explanation appeared in the texts within the images and the posts' captions. We identified seven obstacle categories to CC mitigation concerning the decrease in meat consumption. In iconic signs, the obstacles were represented by fire, meat, and man. In plastic signs, the obstacles are linked to red and black colors. Compared to other signs, linguistic signs provided better descriptions of observed obstacles. The environmental OLs and OLOs mainly

discussed the obstacles related to the *Actions of meat industries* and the *Organization of the action* on both individual and group levels. Other obstacle categories reflected insufficient efforts from the government, personal feelings, other people's actions demotivating pro-environmental efforts, communication and knowledge issues, and stereotypes created by meat lobbies about meat consumption. These obstacles were mainly related to egoistic and hedonic values. Finally, we identified different individual and group entities and non-human objects or concepts in relation to narrative roles. Interestingly, in some posts, the agriculture sector was represented as a victim of government policies and a villain as it largely contributes to CO2 emissions, directly influencing the CC crisis.

7.1.3 Sentiment analysis of the comments

We applied sentiment analysis of the comments to complement content analysis results and categorize the positive, mostly positive, neutral, mostly negative, or negative elements within the comments. The analysis procedure was presented in Section 4.3.3.2 *Sentiment analysis of the comments*. In this part, we focus on the results obtained from analyzing the comments to the posts by environmental OLs and OLOs about meat and vegetable consumption.

The sentiment analysis results of the comments demonstrated that the audiences preferred to use positive elements in their comments since most of the analyzed comments were identified as positive: 64,35%. The results from the sentiment analysis are reflected in Table 39. Almost 17% of the comments were identified as “negative” or “mostly negative.”

Table 39 Sentiment analysis of the comments to the posts by environmental OLs and OLOs considering the food sector in France

Bert_Sentiment	Number of comments	% of total
negative	106	9,11%
mostly negative	88	7,56%
neutral	143	12,29%
mostly positive	78	6,70%
positive	749	64,35%
Total	1164	100,00%

It should be noted here that more comments with negative elements were identified to the posts by organizations than by individuals (Figure 91), which could be related to a highly critical or even radical discourse shared by the environmental OLOs in our data.

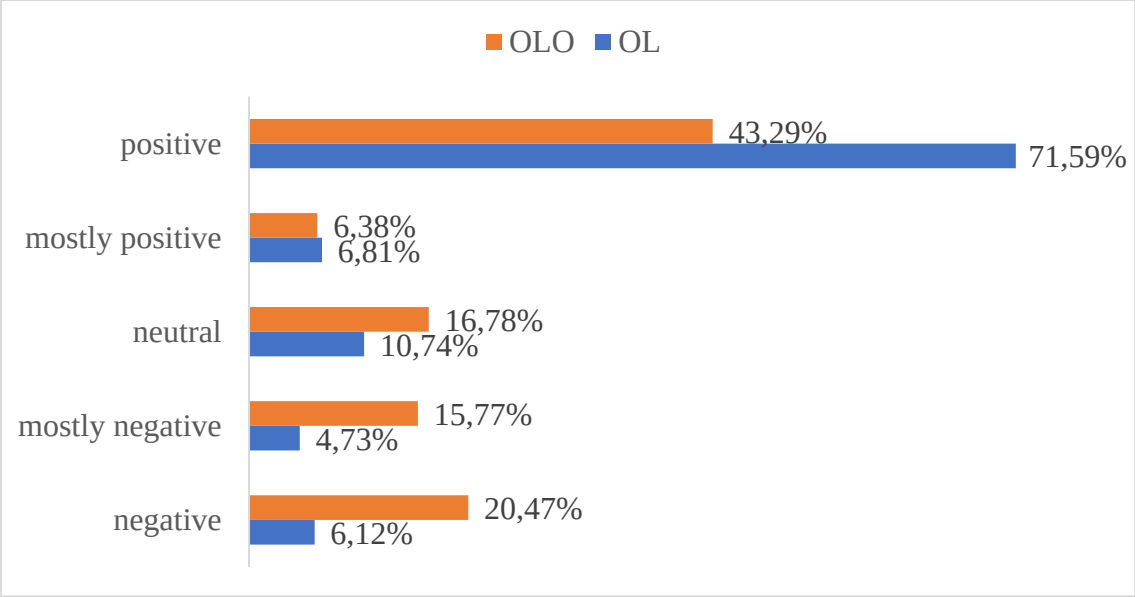


Figure 91 Sentiment analysis of the comments by environmental OLs and OLOs: distribution by enunciator, % of the total number of comments considering each sentiment

In addition to the sentiment analysis of the comments, we combined the results obtained from the content analysis described in the next part and the sentiment analysis results. This crossing of the variables demonstrated that the comments identified during the sentiment analysis as positive almost do not present obstacles in their texts.

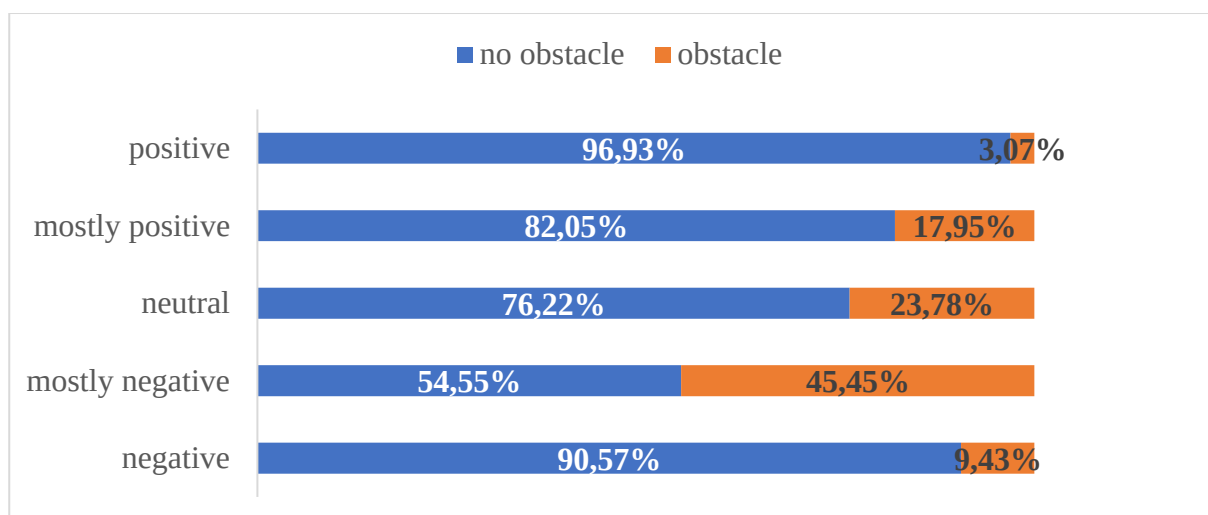


Figure 92 Sentiment-Obstacle relationship in the comments to the posts about food transition in France

The obstacles to pro-environmental behavior appeared more frequently in the comments with mostly negative, neutral, and mostly positive elements (Figure 92). These results only partly confirm our **Hypothesis 3**:

The sentiment analysis of the comments will reveal messages, including obstacles to pro-environmental behavior or skeptical comments, which will be labeled as “negative” or “mostly negative.”

Although the obstacles appeared more frequently in the comments labeled as mostly negative (45,45%), a significant part of the comments containing obstacles was also identified as neutral (23,78%) or mostly positive (17,95%), as illustrated in Figure 92. Therefore, the sentiment analysis method of the comments considering the food sector cannot be the initial source of the obstacle identification. This method demands further fine-tuning and validation. These and other limitations considering the sentiment analysis method are discussed in detail in Section 8.2.2 *Limitations of data analyses*.

To summarize, the sentiment analysis of the comments to the posts by French environmental OLs and OLOs considering vegetarian diets and reducing meat consumption has demonstrated that the audience’s responses to the posts contain generally positive elements. Nevertheless, the negatively labeled comments remain in the corpus, particularly the posts by environmental OLOs. The intersection of sentiment analysis of the comments with manually encoded obstacles demonstrated a chaotic relationship between the obstacles and the identified sentiments in the comments. Although the majority of the obstacles appeared to the posts

labeled as negative, the comments containing obstacles were also identified as neutral or mostly positive by the tool. In the next part, we draw particular attention to the mentioned obstacles, the values in relation to the obstacles, and the narrative roles present in the analyzed comments.

7.1.4 Analyses of the comments

We applied content analysis to investigate the obstacles to pro-environmental action, values concerning them, and narrative roles in the comments. The detailed analysis procedure is explained in Section 4.3.3.3 *Content analysis of the comments*. In this part, we focus on the comments to the French subcorpus of posts concerning meat and vegetable consumption. We start by delineating different obstacle categories and providing examples of them. Where possible, we provide environmental values in relation to the obstacle category. Then, we introduce the narrative roles. We finalize this part by providing specific patterns and linguistic markers of the obstacle discourse.

Only 121 of 1164 analyzed comments (10,40%) to the posts about the food transition by environmental OLs and OLOs in France included the obstacles to pro-environmental actions. These obstacles were either directly or implicitly introduced in the comment's text. By directly communicating the obstacle, we understand clearly communicated obstacle to pro-environmental action by the enunciator. Implicit obstacles mean obstacles evoked or suggested indirectly by the enunciator. In some comments, we observed several obstacles discussed by the author. The identified obstacle categories included *Actions of other laypeople*, *Organization of the action*, *Health*, *Feelings and individual conditions*, *Choice*, *State authorities' (in)action*, *Food quality and characteristics*, *Communication and knowledge*, *Money*, *Stereotypes*, *Actions of companies*, and *COVID-19*. In Figure 93, we illustrate the numbers of each obstacle category calculated as a percent of the total number of occurrences of the obstacles (N=131). In the following paragraphs, we provide different examples of each obstacle category. It should be noted that the orthograph of each example comment was not modified.

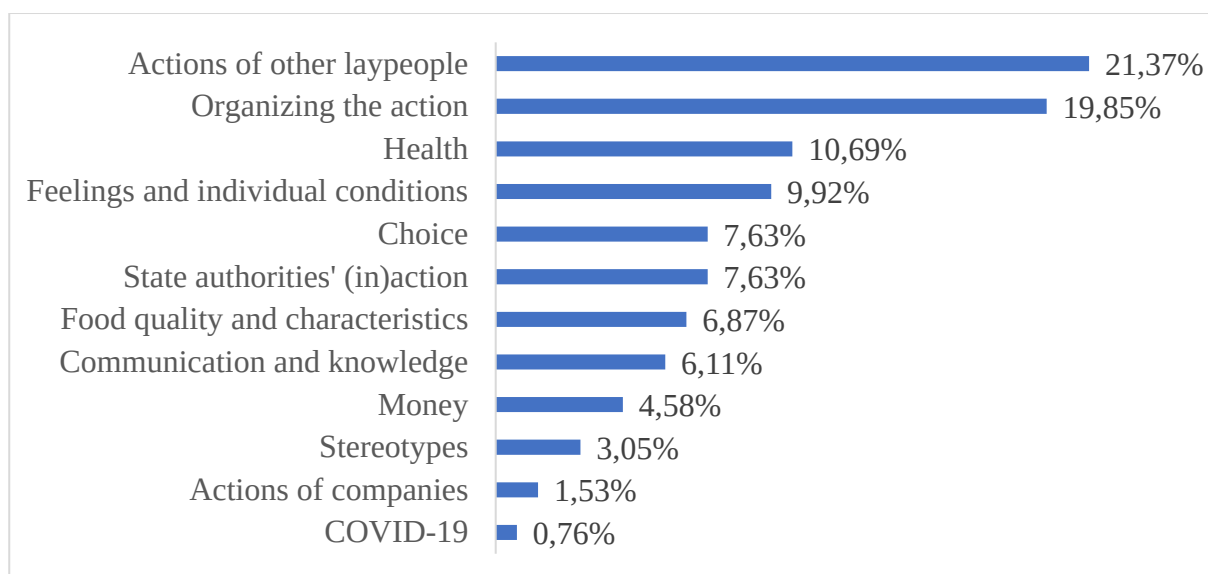


Figure 93 Categories of obstacles in the comments to the posts concerning the food sector in France

The obstacle category *Actions of other laypeople* was discussed in 20% of the comments containing obstacles to CC mitigation, predominantly to the posts by environmental OLs. This category refers to social judgment expressed by other people, such as friends (Comment A) or family (Comment B). In Comment C, the author indirectly evoked that other people may not contribute to CC mitigation and demanded how it can be changed. Examples A and B can be associated with the inner harmony hedonic value item: the importance of harmony, which, however, is bothered by other people's judgments.

A: Oh merci pour ce hors série et en effet pour ce manuel de survie face à Jean Mi. **Je me suis faite traitée de fasciste chez moi par un ami de mon mari samedi.** J'ai pensé à vous tous activistes, ce que vous devez entendre d'humiliant et agressif. Pas toujours facile de se détacher des insultes.

B: Vegetarienne pour ma santé depuis 7 ans. C'est passé comme une lettre à la poste auprès de ma belle-famille française. **En revanche**, ça a été beaucoup plus difficile d'accepter pour ma famille au Québec. J'ai eu droit à des petites piques et des phrases style 'ce qui se passe au Québec reste au Québec'.

C: Bravo pour tout ce que vous faites pour ouvrir les consciences. Je vous ai regardé hier et je me demandais comment faire changer les mentalités? Si j'aime votre compte c'est que j'adhère à vos idées **mais je demande comment ouvrir les yeux aux autres qui n'ont pas le même regard que nous...**

The obstacle category *Organizing the action* appeared mostly to the posts by OLs. It can be described by denying the need to act in the food sector since the energy sector and industries are the priority (Comment D). Besides, other comment authors evoked the impossibility of acting on the global level (Comment E) or on the level of school canteens that can not efficiently organize vegetarian menus (Comment G). At the individual level, organizing the action can be linked to the difficulty of finding plant-based balanced meals (Comment F). Comments F and G can be related to the hedonic value of comfort.

D: C'est bien beau tout ça **mais** il faudrait qu'on m'explique comment on arrive à avoir un pays fort et concurrentiel, en prenant la question de l'écologie, ne serait ce qu'au niveau de l'énergie, et l'industrie.

E: Mais ce que je pointait du doigt dans mon commentaire c'est que ça avait beau être 'écolo', **ce serait impossible d'utiliser cette méthode a l'échelle mondiale.**

F: Moi je n'y suis pas encore mais je réduis clairement la viande. Ce n'est pas simple car mon mari n'est pas prêt a arrêté la viande mais ok pour réduire. **Ce que je trouve compliqué (peut etre une excuse?) C'est trouvé les recettes, l'équilibre des repas etc en plus du reste du quotidien...** mais bon je me dis que ça prend du temps mais l'essentiel est d'aller dans le bon sens 😊

G: 🙄 Ce que tu as bien expliqué aussi hier c'est qu'ici **c'est pas facile de manger végétaLien (on peut y arriver mais c'est pas toujours facile)**, a propos des repas végétaRiens dans les cantines ce serait top qu'ils y en ai plus souvent de proposer **par contres je me pose la question pour le poisson qui est justement proposé dans le repas végétarien 🙄??.....donc ce n'est pas un repas végétarien ???** Et en ce qui concerne le tri des déchets c'est la cata!!! (il n'y a même pas de poubelle verte dans mon immeuble 😞). Marion de Lyon

The obstacles in relation to *Health* concerned mainly personal beliefs that ceasing meat consumption can negatively influence personal health (Comment H) since vegan food is not balanced (comment I). These arguments can be linked to the egoistic value item of personal health. In addition, several comments emphasized the negative influence of vegan diets on babies' health (Comment J). Comment J is closely connected to the altruistic value item of other people's health.

H: **Arrêter de consommer toute viande ne serait pas une solution non plus pour des raisons de santé** ET d'environnement, la viande est la meilleure sources de protéines et de certains macronutriments.

I: Le régime vegan n'est pas équilibré

J: si tu fais manger vegan a un bébé il risque fort de mourrir et que **les enfants vegan se retrouvent souvent handicapés**

Feelings and individual conditions obstacle category refers to personal beliefs and attitudes influencing climate inaction. For instance, Comment K discussed personal feelings of discomfort due to being an “environmental extremist,” which can demotivate personal environmentally-friendly efforts.

K: C'est une période de creux pour ma part, **je crois que je suis partie trop extrémiste, du coup j'ai reculé.** A reprendre de façon progressive et pas trop restrictive !

The obstacle category of *Choice* reflects the problems with obliged or voluntary actions. On the one hand, some people believed that the environmentally-friendly actions should not be imposed (Comment L and Comment N). On the other hand, they suggested that the actions should not be voluntary (Comment M). Comment M is also linked to the *Organization of the action obstacle*, i.e., school canteens should better manage vegetarian menus. This obstacle category can be linked to the use of social power by schools (egoistic value).

L: **Par obligation c'est encore plus con** ... mon fils en lycée agricole public n'a que du végétarien à la cantine... et je peux vous dire que c'est contre productif car il en a par dessus la tête des steaks vege et cie !!!! Ils sont à des âges ou ce genre de contrainte ne sert à rien si ce n'est les dégoûter. Leur laisser le choix serait plus intelligent !

M: **Mais par volontariat c'est totalement con !!** Dans tt les cas l alternative viande sera préparé donc ça sert à rien !! Il faut au moins demander en début d année aux élèves si ils préfèrent pr tt l année manger 1,2 ou tt les jours de la semaine vegé pour adapter les rations et éviter la viande inutile ! ☺

N: Le truc cest que si tu a envie de manger végétarien tant mieux pour toi, **juste ils ont pas à imposer ce régime alimentaire aux autres. Tu as tes convictions j'ai les miennes**, je trouve pas ça normal que dans une cantine scolaire on impose un repas végétarien

The obstacle category *State authorities' (in)action* appeared mainly in the comments to the posts by environmental OLOs. The comments' authors highlighted the insufficient or delayed actions from the government (Comment O). In addition, the government's support of lobbies – yet not specified in which industry – was seen as a barrier to global action in Comment P. Also, specific supporting actions by political leaders were seen as obstacles, such as President

Macron's policies to support *Total* energy company and airline transports instead of supporting the agriculture sector (Comment Q). This obstacle category can be linked to the egoistic value items of authority (Comments O and Q) or wealth (Comment P).

O: Mdrrr aucun combat au niveau du gouvernement n'a été remporté du coup ça se tourne vers nous et nos assiettes. Bonne initiative et bon coup de comm mais loin de changer quoique ce soit

P: 🐦 ces individus qui doivent gouverner , sont-ils des phénix indubitablement NON. Ils voient que leur ÉconOMIE Libérale la seule enseignée à l' École Nationale des Ânes E.N.A. si chère à monsieur le jupiter ... l' Indice Carbone est le cadet de leurs soucis " Lobbying des Lobbys " ...

Q: @b_pompili à vous de jouer devant @emmanuelmacron qui continue de soutenir Total et les Transports aériens **mais** qui refuse les aides aux bio-agriculteurs, par exemple 😞😞😞

Some people mentioned the *Quality and characteristics of plant-based food* as personal barriers to adopting vegetarian diets. One author expressed this obstacle directly in comment R with the phrase “des lasagnes/steaks/bolognaises végétales dégueulasses” (Comment R). Another comment implicitly evoked the obstacle; the emoji 🙄 can contribute to understanding the obstacle's representation. This obstacle category is generally linked to the hedonic value item of enjoying life's pleasures, such as food.

R: C'est bien d'être content après **c'est pas vous qui bouffez des lasagnes/steaks/bolognaises végétales dégueulasses** vous savez très bien que c'est pas de la nourriture qui peut-être bonne préparée dans ces conditions

S: Puis faut voir les repas végétariens.. Omelette bouillie, burger ou nuggets vege. Les lentilles, haricots secs ? **Connais po** 🙄

The *communication and knowledge* obstacle category was closely connected to personal feelings in this subcorpus of comments. Comment T demonstrates the individual's incomprehension of why dairy product consumption is not recommended to be reduced, but meat consumption should be reduced. Although a person changed their consumption habits, there is still a certain level of incomprehension about adopting vegetarian diets.

T: Mais vous mangez œufs lait et fromage ? Je suis passée il y a de cela 8 mois à une alimentation plant-based, j'étais omnivore, en évitant souvent la viande. **J'avoue que je ne comprend pas trop pourquoi le lait oui mais l'animal non...** c'est pour cela

que mon cheminement sur le changement d'alimentation c'est tout de suite porté sur le 100%végétal.

The obstacles related to *Money* were closely connected to consuming local products, which can be expensive and not frequent in specific locations (Comment U). This example can also be linked to the organization of the action obstacle category, yet with specific precision about financial issues. The egoistic value item of wealth can be linked to this obstacle category.

U: Et puis consommer local **c est facile à dire mais moins dans les faits... prix ...** rareté dans certains endroits....

The *Stereotypes* obstacle category appeared to the post by Greenpeace from Figure 85 and can be closely connected to the communication by food companies as demonstrated in Comment V. The egoistic value item of influence can be linked to this obstacle category.

V: Quel sacré fantasme entretient le secteur depuis bien longtemps. **A cause de cela beaucoup pensent toujours que Viande = Virilité** 😏

Actions of companies were mainly discussed in the comments to the posts by OLOs and can be described as companies' or industries' activities, which can decelerate sustainability transition in the food sector. Example W underlines the negative impacts of intensive agriculture, which can be linked to the egoistic value item of wealth since the agriculture industry gets financial profits from intensive farming.

W: [...] Et de cette prise de conscience de cet empoisonnement global par **la trajectoire empruntée de notre agriculture intensive pour en être absolument absurde**. Et de nous mettre de fait en danger de mort par cet **aveuglement** qui ne porte pas de noms et qui **repousse toujours les limites édifiées par les consommateurs** qui répondent à cette offre de **l'empoisonnement chimique que l'agriculture utilise pour satisfaire des rendements économiques** et dont le but premier est de satisfaire leur cupidité dans un sinisme qui vient nous heurter frontalement et de comprendre à travers cette passivité de consommer que notre responsabilité est engagée. [...]

The *COVID-19* obstacle category appeared in a few comments linking personal inaction to the COVID-19 crisis, as shown by Comment X.

X: Ici aussi les efforts ont été un peu relâchés ces derniers temps a cause du **COVID**, mais la motivation est de retour ! Ça fait bizarre d'avoir l'impression de repartir de zéro alors que non j'ai gardé de nombreuses habitudes en place !

The majority of observed values in relation to the obstacles considered egoistic or hedonic values. Interestingly, the altruistic value concerning one obstacle was observed in a comment where the author cared about the health of children who eat vegan food (Example J above). Biospheric value was once mentioned in a sarcastic comment concerning meat consumption. The author wrote: “Vous vous rendez compte **qu’en tuant une vache on nourrit 20 personnes alors qu’il fait massacrer des centaines de petits pois pour nourrir une seule personne pour un repas?!?**” We cannot verify whether a bot wrote the comment, but we can estimate that the sarcastic tone of the message can be connected to the obstacle or even disinformation.

The narrative roles of heroes in the comments were generally attributed to ‘myself’ or my family, “us” or all people, “you” (other people in comments or the posts’ authors), agriculture, climate activists, scientists, government, and politicians (e.g., Barbara Pompili). The villains in the comments were schools, school canteens, “they,” “us,” or all people, French citizens, government, companies (e.g., McDonald’s), politicians (President Macron), agriculture, climate activists, red meat, intensive agriculture, politics, friends, family, and society. The victim roles were attributed by the authors of the comments to “you” – the readers, “us” or all people, children, nature, “myself” or my family, animals, cows, people eating red meat, vegan babies, small towns, and ecosystems.

To complement the content analysis of the comment, we applied the Concordance function in *Sketch Engine*, which allowed us to visualize the phrases containing “mais.” In fact, this conjunction frequently appeared in the comments: *Sketch Engine* identified 71 occurrences of “mais” in the comments containing obstacles. However, only 21 example phrases with “mais” were related to the obstacles. We illustrate several examples of obstacles containing “mais” as a marker of this discourse in Figure 94.

Details	Left context	KWIC	Right context
1 oisson, je privilégie les fruits et légumes qui viennent de la ferme (en deuxième choix bio	mais	en général c'est moins local que la ferme qui est derrière chez moi 😊).	Je n'achète
2 mer de nombreuses espèces.	Une partie de la population peut être végétarienne	mais	une population entièrement végétarienne ne nous sauverait pas." Et bien, après avoir ég
3 mari a suivi sans souci, les enfants parfois mangent des protéines animales à l'extérieur	mais	plus par pression sociale que par conviction, vive l'adolescence 😊.	Dans l'entou
4 me percutent !	Parce que dans le fond je sais que tu as raison !	J'essaie	mais pas assez !
5 t jamais avec des réflexions de long terme.	Le pouvoir rime bien trop avec argent	mais	ce que nos gouvernants semblent oublier c'est que lorsque la planète serait inhabitable c
6 an expliqué aussi hier c'est qu'ici c'est pas facile de manger végétalien (on peut y arriver	mais	c'est pas toujours facile), a propos des repas végétariens dans les cantines ce serait top	
7 de certains macronutriments.	Il serait possible de les remplacer par des végétaux	mais	ceux-ci seraient bien moins assimilés par le corps et moins productifs (ration kg/kg/protéi
8 <Leur laisser le choix serait plus intelligent !	@tenguuuu_ on est bien d'accord	mais	dans son lycée c'est vege ou ... vege.. pas d'alternative possible !
9 ouer devant @emmanuelmacron qui continue de soutenir Total et les Transports aériens	mais	qui refuse les aides aux bio-agriculteurs, par exemple 🙄🙄🙄	

Figure 94 Use in the context of “mais” made with Concordance function in Sketch Engine, comments data about meat consumption and vegetarian diets in France

Figure 94 shows that “*mais*” was used to discuss such obstacle categories as *Organisation of action* (lines 1, 2, 4, 7), *Actions of other people*, such as social pressure (line 3), *Personal conditions* (line 4), *State authorities in action* (lines 5, 9), and *Choice* (line 8).

Besides the markers of obstacles, we visualized the verbs frequently used with nouns *végétarien* and *viande* from the corpus of comments containing obstacles. The verbs frequently used with *végétarien* as object included *être*, *devenir*, *manger*, *suivre*, *empêcher*, *avoir*. The verbs used in combination with *viande* as an object were *arrêter*, *éviter*, *aimer*, *cramer*, *consommer*, *réduire*, *avoir*. These verbs are illustrated in Figure 95. Overall, these verbs reflect the proposed solutions to CC mitigation in the food sector: become vegetarian, eat vegetarian food, follow vegetarian diets, stop eating meat, avoid eating meat, and reduce meat consumption.

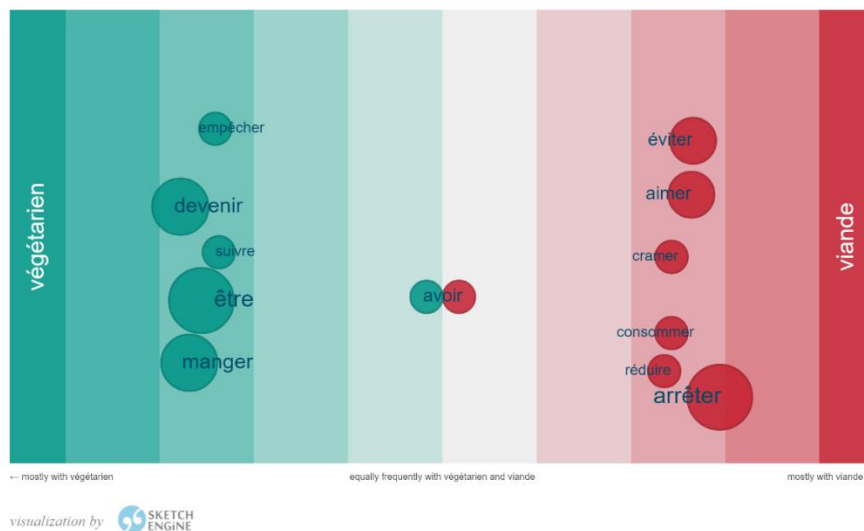


Figure 95 Word Sketch difference, verbs used with “*végétarien*” and “*viande*” as objects in comments, made with Sketch Engine

With the help of *Sketch Engine*, we also visualized modifiers used frequently with the two nouns and illustrate them in Figure 96. The modifiers of *végétarien* included *menu*, *quotidien*, and *alternatif*. The modifiers of *viande* comprised *rouge*, *industriel*, *inutile*, *alternatif*. Although *Sketch Engine* automatically selected the colors of each word, we noticed that the word *viande* was more frequently used with negative connotations and attributed to the “villain” category.

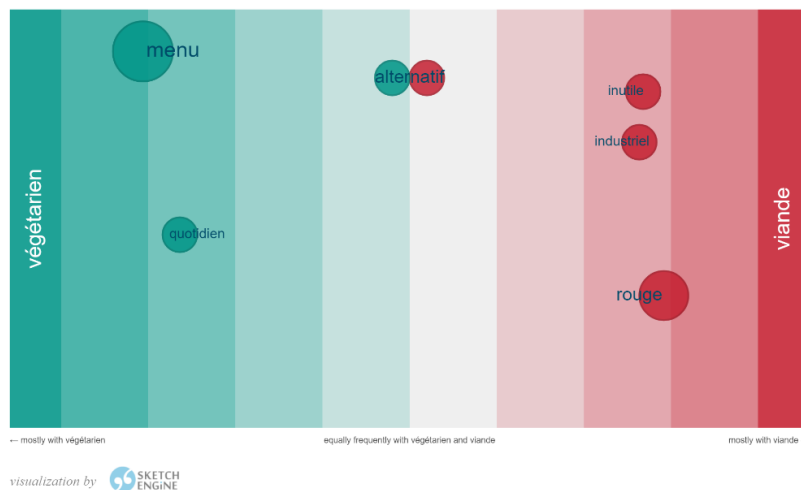


Figure 96 Word Sketch difference, modifiers of “végétarien” and “viande” in comments, made with Sketch Engine

To summarize, most comments on the posts by French environmental OLs and OLOs about meat consumption and vegetarian diets were positive-oriented. The authors discussed their attempts to reduce meat consumption and shared tips. However, 10% of the comments included different categories of personal or group obstacles to adopting sustainable food practices. It should be noted that most personal obstacles, such as *Feelings and individual conditions*, appeared in the comments to the posts by environmental OLs. The *Actions of other people* and the obstacles in relation to the *Organization of pro-environmental actions* were represented in the majority of comments containing obstacles. It is interesting that the *Choice*-related obstacles referred to the necessity to have more options or to organize a voluntary action and, at the same time, the necessity to be obliged to do the action, e.g., reducing choice options in school menus to follow vegetarian diets. Overall, the obstacles were linked to egoistic or hedonic values. However, two comments including obstacles mentioned care for plants (biospheric value) and children (altruistic value) as arguments supporting inaction. Different human or non-human figures and group entities were named heroes, villains, and victims in the analyzed comments. The conjunction “*mais*” can be seen as a linguistic marker of obstacle discourse.

7.1.5 Discussion and summary of the results

In this part, we summarize and reflect on the results from our mixed-method study of Instagram posts and comments to them regarding the adoption of vegetarian diets and reducing meat consumption communicated by French environmental OLs and OLOs in January 2021–March

2022. We applied multimodal discourse analysis combined with computer-assisted linguistic analysis to the posts. In addition, we used a three-method approach to investigate the comments, incorporating sentiment analysis, content analysis, and computer-assisted linguistic analysis. This combination of methods offered a multifaceted perspective on the topic. Specifically, we overviewed the multimodal data in a broader sense and identified trends and patterns concerning the obstacles to pro-environmental action, environmental values related to these obstacles, and narrative roles appearing in the posts and the comments.

Human figures and food appeared more frequently in the analyzed images regarding the observed iconic signs. In these visuals, people were portrayed engaging in various enjoyable activities, and food was represented as attractive. This representation of people and food can be linked to the hedonic value item of enjoying life. The images of the main characters of the Friends TV series were used as a memetic or humorous technique to advocate for reducing meat consumption. A study by Joustra, Alfaro, and Giacomani (2023) showed that memes about vegetarian lifestyles promote conflicts between people following vegetarian and non-vegetarian or non-vegan lifestyles. In this case study, we did not observe conflicting forms in the memes, but we suppose that they may appear on Instagram and negatively influence peoples' perceptions of vegetarian diets. In this context, we suggest that OLs and OLOs should carefully choose the use of memes to promote reducing meat consumption.

The environmental OLs used images mainly as illustrations or knowledge images, as defined by Catellani (2018). Illustrations depicted mainly personal photos of environmental OLs (sometimes in the role of ethos images (Catellani, 2018)) and photos of proposed solutions: following vegetarian diets or reducing food waste. Ethos images were a part of illustrations since they mainly served to visualize what had been discussed in the caption. We demonstrate several typical illustrations in Figure 97. These illustrations frequently reflected hedonic values of enjoying life's pleasures such as food, hobbies, or interests.



Figure 97 Illustrations in the posts about food themes by environmental OLs and OLOs in France

The second significant type of visuals included text on-screen elements, such as infographics or short articles explaining different solutions or problems concerning reducing meat consumption or adopting vegetarian lifestyles. We demonstrate several examples of such images posted by environmental OLs and OLOs in Figure 98. Generally prevalent in communication by climate scientists and news media (M. Schäfer & Xiaoyue, 2023), infographics are frequently used as a rhetoric strategy by NGOs (Catellani, 2022). In the present case study, infographics were equally used by individuals and organizations.



Figure 98 Knowledge images in the posts about food themes by environmental OLs and OLOs in France

In their Instagram communication about the sustainability transition in the food sector, Greenpeace frequently used dramatic and provoking images, as discussed in Figure 85 in the previous part. These visuals may induce fear and create a distance with viewers, leaving them overwhelmed or helpless (O'Neill & Smith, 2014). The emotional aspects and dramatic forms of visuals used by Greenpeace in their campaigns were already emphasized by communication research (Brennan & Merkl-Davies, 2014; Catellani, 2018; Dawkins, 2009; DeLuca, 2005; Doyle et al., 2009; Pramana et al., 2021). In this case study, we also observed that such rhetoric

images obtained the highest number of likes and comments, which could also be influenced by a higher number of Greenpeace followers than other organizations.

Although videos can positively influence awareness and concern about CC issues (Ballantyne et al., 2016) and contribute to potential behavioral change (Allgaier, 2019), the environmental OLs and OLOs neglected this type of content. Only 12% of the posted visuals in this case study were videos. Six of the nine videos were Instagram Reels, i.e., short, entertaining videos up to 60 seconds in 2021–2022 and 90 seconds in 2024. Although Instagram Reels are not frequent in this case study, we suppose that, with the development of Instagram's new functions and the popularity of video content, the OLs and OLOs post more videos today.

The Reels in this corpus adapted a format of short humorous TikTok videos, including cheerful music and humorous elements, as shown by video frames in Figure 99. Figure 99 shows a vegan person criticizing “*les anti-végan*” for their stereotypical view of vegan diets: eating only herbs. These critics can also be linked to the conflict frames frequently present in memetic discourses about vegetarian and vegan lifestyles (Joustra et al., 2023). In addition, Anderson (2020) claimed that this video format can be seen as an imitation of TikTok videos and can be used to engage new potential audiences with the proposed content. Thus, we suggest that more research on recently posted Reels and user engagements is needed to investigate better video formats to communicate about vegetarian or vegan lifestyles.



Figure 99 Reels in the posts about food themes by environmental OLs in France

The observed plastic signs of the posts' visuals demonstrated the presence of dark colors, such as black, brown, grey, and dark green. Nature-associated green and blue colors were used mainly as background for textual information. The red-orange and black colors were associated with obstacles to climate action in some images. They were used as colors of fire or texts' colors underlining the obstacles, which intertwined the meanings within the plastic and iconic signs.

Almost 90% of the visuals included text (linguistic sign) as a central element, without which it could be challenging to identify the obstacles to CC mitigation in the posts. This leads us to the significant role of a combination of multiple signs – iconic, plastic, and linguistic – within an Instagram post to communicate about the sustainability transition in the food sector. Therefore, we confirm our **Hypothesis 2:**

The obstacles will be more clearly stated in the verbal mode of the posts, i.e., captions or text-on-image elements, on Instagram.

Overall, the obstacles observed in the linguistic signs of the posts can be divided into six categories: actions of companies, actions of the government or state authorities, problems related to the organization of the action, personal feelings, other people's actions, and communication-related issues. Insufficient actions from government, companies, or agriculture industries were frequently associated with egoistic values. Problems concerning the organization of proposed solutions or personal feelings of anxiety were frequently in line with hedonic values.

If we apply framing theory, which broadly means highlighting some facets of communication (Entman, 1993), reducing meat consumption was not a predominant frame in the analyzed posts. Most posts emphasized the adoption of vegetarian or vegan diets as an essential solution to the sustainability transition in the food sector. Indeed, the environmental OLs and OLOs often discussed vegetarian food choices by providing plant-based recipes, which can be an effective strategy to stimulate the transition (de Boer & Aiking, 2017). Interestingly, another study demonstrated that the “reducing meat consumption” frame often used in media articles can negate traditional values and personal choices (Sievert et al., 2022). In our data, this claim was mainly supported by comment data, expressing criticism towards reducing meat consumption.

Reducing meat consumption and following vegetarian diets as solutions to CC mitigation were primarily debated in the comments to the selected posts. As in the article by Huot (2019) in the digital journal ADN, our findings demonstrated that French people were aware of vegetarian diets as possible solutions in the food sector; however, not everyone was ready to contribute to this action.

The audiences' responses in the comments were contextualized and frequently addressed personal attitudes, experiences, fears, or barriers to adopting plant-based diets. The main obstacles in the comments discussed actions by other people who do not contribute to CC

mitigation, problems with the organization of the action, individual feelings, choice, actions by state authorities, food quality, communication and knowledge, money, stereotypes, actions of companies or agriculture workers, COVID-19. In several comments, the conjunction “*mais*” was used as a marker of obstacle discourse.

The obstacles discussed in the comments were mainly related to the authors of the comments or attributed by the authors to other individuals or entities. In general, the audiences’ inaction was influenced by other people’s actions, which were considered insufficient. Indeed, individual feelings of fear or anxiety demotivating adoption of vegetarian diets were frequently influenced by social judgment (can be linked to hedonic value item of inner harmony), poor regulation of the vegetarian menus in schools (can be linked to egoistic value item of social power), or controversial communication about plant-based diets. Besides, the problems concerning poor vegetarian food quality and taste mentioned in the comments can be linked to the hedonic value item of enjoying life and food. These hedonic values are essential for French citizens when choosing plant-based alternatives and purchasing food products in general (L’Observatoire Société & Consommation, 2024).

We observed an interesting phenomenon regarding choice-related obstacles. On the one hand, the authors of the comments emphasized poor choice options, which can demotivate the consumption of plant-based food. On the other hand, people have too many options and, therefore, should be obliged to eat vegetarian food in schools. These opposing opinions were directly linked to regulating vegetarian menus in schools.

According to L’Observatoire Société et Consommation (2024), the price of organic food and the uncertainty about producing organic products are the major factors that negatively influence their consumption. In our data, the price of local and organic fruits and vegetables was mentioned as a barrier to the adoption of the action. The price here can be associated with egoistic value wealth item, which is largely present in the comments to the analyzed posts. Economics scholars suggest that to overcome this obstacle, we need to develop more convenient and cheaper options for plant-based diets (de Boer & Aiking, 2017). The uncertainty about the production of organic products – communicated by L’Observatoire Société et Consommation (2024) – refers to the doubtful perceptions of French citizens regarding the places where this food was produced, i.e., while agriculture workers may not use pesticides to grow their products, the area where they are grown can be polluted by other sources. We can link this

uncertainty to controversial actions by food companies and the agriculture sector discussed in the analyzed comments.

The influence of vegetarian diets on personal health was discussed in comments, specifically related to iron deficiency or pregnancy, representing a significant factor demotivating the adoption of vegetarian diets. Another study on Twitter data demonstrated similar results, where fear of vegan lifestyles was related to health issues (Shamoi et al., 2022). This obstacle category is directly related to the egoistic value item of personal health. However, a more recent report demonstrated that the importance of taking care of nature and personal health in relation to food purchases has decreased compared to previous years (L'Observatoire Société & Consommation, 2024). We suggest that this can be related to a global world crisis that appeared with the wars in Ukraine in 2022 and the Middle East conflicts that escalated in 2023. These crises took a central place in media and people's attention.

As discussed in the paragraphs above, the obstacles to pro-environmental efforts were generally linked to egoistic and hedonic environmental values in most posts about adopting vegetarian diets and reducing meat consumption by environmental OLs and OLOs in France. In addition to this, the obstacles in comments were also connected to hedonic and egoistic values, which confirms our **Hypothesis 1**:

The obstacles to pro-environmental behavior in both posts and comments to them will be predominantly referred to the egoistic or hedonic values.

The intersection of sentiment analysis of the comments with manually encoded obstacles demonstrated a chaotic relationship between the obstacles and the identified sentiments in the comments. Although the majority of the obstacles appeared to the posts labeled as 'negative', the comments containing obstacles were also identified as "neutral" or "mostly positive" by the tool. Thus, we cannot fully confirm our **Hypothesis 3**:

The sentiment analysis of the comments will reveal messages, including obstacles to pro-environmental behavior or skeptical comments, which will be labeled as "negative" or "mostly negative."

Future research can improve the accuracy of identifying obstacles with the help of sentiment analysis by refining the suggested BERT model on climate-related data.

The narrative roles of heroes, villains, and victims were largely represented in posts and comments and are summarized in Figure 100. In the paragraphs below, we describe each narrative role.

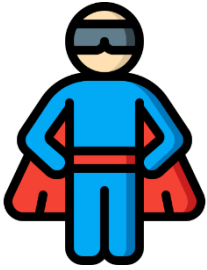
			
Posts	myself, you, my family, people changing their consumption habits, we, all people, organizations, “on”	children, agriculture workers, organic food shops, us, all people, biodiversity, planet, environment, trees, animals, people from poor and lower middle classes	politicians (Emmanuel Macron, Valérie Pécresse), “anti-écologues”, meat lobbies, family members, rich people, fossil fuel companies, companies, meat industry, meat, France, habits, climate extremists, friends
Comments containing obstacles	myself, my family, we, all people, you, agriculture, climate activists, scientists, government, politicians (Barbara Pompili)	you, we, children, nature, myself, my family, animals, cows, people eating red meat, vegan babies, small towns, ecosystems	schools, school canteens, they, we, all people, French citizens, government, companies (McDonald’s), politicians (President Macron), agriculture, climate activists, red meat, intensive agriculture, politics, friends, family, society

Figure 100 Narrative roles in the posts considering vegetarian diets and reducing meat consumption by environmental OLs and OLOs in France

In general, the environmental OLs in France and their audiences mentioned different individual actors as heroes that need to contribute to the sustainability transition in the food sector: “myself,” “you” (the readers), people changing their consumption habits, climate activists, scientists, and politicians. On a group level, the heroes are families, “we” or all people, organizations, the collective pronoun “on,” government, agriculture. The roles of the government and agriculture were explicitly highlighted in the analyzed comments.

The villains are a well-represented category of narrative roles in the posts and comments. This category included politicians (Emmanuel Macron, Valérie Pécresse), “anti-écologues,” climate extremists, climate activists, wealthy people, and friends. At a collective level, the villains were represented by meat lobbies, meat industries, fossil fuel companies, companies in general, France, schools and school canteens, agriculture, intensive agriculture, family, and society. Interestingly, “climate extremists” was a term used in the posts, “climate activists” –

in the comments. Different inanimate nouns also represented villains: personal habits, meat, red meat, and politics.

The victims in the posts and comments were frequently related to biospheric and altruistic values – care for nature and care for other people. For instance, individual victims were represented by “myself,” my child, children in general, people from the poor or lower middle classes, people eating red meat, “you” (the readers), and vegan babies. Collective victims included all people or humanity, agriculture workers, shops, and small towns. Nature-related victims were represented by biodiversity, planet, environment, trees, animals, cows, and ecosystems.

Interestingly, politicians and agriculture were primarily criticized for their insufficient action in the posts and comments to them, which we notably observed in the organizational discourse. However, according to the analyzed comments, they are expected to contribute to the main action to the sustainability transition in the food sector. This attribution of responsibility can be related to other communication studies in European contexts highlighting the shift in responsibilities from individual consumers to companies, such as supermarkets (Evans et al., 2017) or industries and governments (Moerschel et al., 2022). Although these entities are more frequently represented as villains in the posts and the comments, they are also frequently mentioned as heroes, i.e., responsible actors for CC mitigation.

To summarize, the posts about the sustainability transition in the food sector in France demonstrated generally a solution-oriented discourse. Nevertheless, with the help of a mixed-method research design, we could identify different obstacles or barriers to the sustainability transition in this sector. In the posts, the obstacles were mainly related to the collective actions of companies, the agriculture sector, and the French government. These obstacles were mainly represented in the captions. However, in some cases, red-orange and black colors, the image of fire, meat, or cow were associated with the obstacles. In the comments, the obstacles were focused on individual barriers, such as actions of other laypeople, problems with the organization of the action, personal health, or other individual conditions. We suggest that communicators about the sustainability transition in the food sector should orient their communication to a rather practical discussion of solutions or tips regarding each observed barrier on an individual level. In Section 8.3.1 *Implications for communication practitioners*, we provide more practical recommendations concerning communication about the sustainability transition in the food sector.

Although the data from this study covered the COVID-19 crisis, the COVID-related obstacles were not numerous. In posts and comments to them, these obstacles were linked to egoistic or hedonic environmental values. The most frequently commented posts were the posts by Greenpeace France, which were well-constructed and used dramatic, provoking, rhetorical visuals. The observed narrative roles in the posts and comments allowed us to construct a narrative world within the French Instagram discourse about sustainability transition in the food sector. All these elements and observed patterns contribute to a broader understanding of the obstacles, the values behind them, and the main actors of the analyzed discourse.

7.2 Case study 2: Communicating about sustainability transition in the transport sector in France

The present case study discusses the communication about the sustainability transition in the transport sector by environmental OLs in France. First, we introduce the selected data. Second, we provide the results from multimodal discourse analysis of the posts, which are complemented by computer-assisted linguistic analysis to provide more explicit examples of certain phenomena. Third, we demonstrate the results from the sentiment analysis of the comments. Fourth, we present the results from the content analysis of the comments. Finally, we conclude by reflecting on the results of this case study.

7.2.1 Selected data

To examine the communication about the sustainability transition concerning the transport sector in France, we selected a set of posts by environmental OLs from the *Corpus21-22_FET* obtained from an automated content analysis (cf. Section 4.3.1 *Automated content analysis*) and multimodal content analysis (cf. Section 6.2.1 *Instagram communication by environmental OLs about the sustainability transition in the food, energy, and transport sectors in France*). These posts discussed the improvements related to public transportation and individual car use. The main criterion for selection was the presence of obstacles in the posts concerning the transport sector, which was predominant in the subcorpus by environmental OLs in France.

Overall, we selected 17 posts by environmental OLs in France. In general, the OLs posted images as media content: images were present in 96,55% of the posts. The media files included 56 images and two videos. On average, the OLs posted 3,26 images per post. The highest number of images posted within one post was shared by @julienbayou and

@ecolo_mun_cul, who posted ten images within one post. As a rule, environmental OLs' posts included images or videos: no posts combined image and video content.

During the data collection stage, we also obtained 713 comments to the selected posts considering the use of public transport and individual cars by environmental OLs in France. Before analyzing the comments, we cleaned the data by deleting mentions and links to other resources since they do not possess any emotional function. We also deleted the duplicate comments posted by the same person to the same post. Overall, we obtained 651 clean comments for the sentiment analysis, representing 91,30% of the collected comments.

The detailed analysis procedures are provided in Section 4.3.3 *Case studies' analyses: a mixed-method approach*. In the following parts, we delineate the results from mixed-method analyses.

7.2.2 Multimodal discourse analysis of the posts

To understand the representation of the obstacles, values, and narrative roles concerning transport sustainability in France, we conducted a multimodal discourse analysis of 17 selected posts by French environmental OLs. The analysis grid and detailed procedure are provided in Section 4.3.3.1 *Multimodal discourse analysis of selected posts*. In the following paragraphs, we discuss the analysis results following the analysis grid: first, we discuss iconic signs; second, we introduce plastic signs; third, we highlight the linguistic signs.

To start with, the posts by French OLs reflected on different themes related to the sustainability transition in the transport sector. In their Instagram posts, OLs discussed possible solutions to the climate crisis in this sector, attributed responsibilities to different actors, demonstrated personal experience, promoted political campaigns, and attempted to engage their audiences in climate action. By the audiences in this part, we understand the people commenting on the selected posts.

Regarding the **iconic signs**, i.e., what is represented in the post and what it signifies, the OLs tended to post images of people, showing personal examples of contributing to climate action or just supporting a text with a personal photo. Indeed, we observed human figures in 24 out of 56 images. These human figures were represented by environmental OLs themselves, political leaders, celebrities, and climate activists. Politicians were portrayed positively as contributing to climate action in several pictures. In the two pictures, the represented political figures questioned the proposed solutions or responded ironically to controversial solutions

proposed by the government. For example, a set of images demonstrated an ironic response to controversial solutions regarding individual and electric vehicle use proposed by the government and supported by the automobile industry by using portraits of Jean Castex (French Prime Minister in 2020–2022), Elon Musk (entrepreneur), and human fiction characters represented by film celebrities. These ironic phrases are demonstrated in Figure 101. Although these human figures are related to the obstacles to pro-environmental efforts, it would be impossible to link them to the obstacles and villains without the verbal component of the images and post’s caption.



Figure 101 Extracts from a post by @ecolo_mon_cul, 24.03.2022

Such human figures as “myself,” “us” or all people, climate activists, and Green Party politicians, such as Julien Bayou, were represented as heroes in the analyzed posts. In Figure 102, @julienbayou represented himself as a possible hero, i.e., ethos image emphasizing the role of enunciator, as in Catellani’s (2018) typology. However, the role was emphasized in the verbal mode – text from the post specifically.

Macron : refuse d'interdire la pub pour les SUV

Julien Bayou : hold my diabolo menthe



julienbayou  Puisque Macron refuse d'interdire la pub pour les véhicules polluants, je le ferai en Île-de-France : à partir de 2022, plus aucune publicité pour des SUV dans le réseau de transports en commun. (Et pour réduire la place de la publicité dans les transports, on a aussi fait une pétition, le lien est en bio)

Figure 102 post by @julienbayou, 02.04.2021

Political figures, such as Emmanuel Macron (mentioned in the text within the image and in the post's caption, Figure 102), Valérie Pécresse, or Jean-Luc Moudenc, and entrepreneurs, for instance, Elon Musk (on the top right in Figure 101), were named explicitly as villains. Children, “us” – all people, and citizens were mentioned as the human victims of harmful activities by the villains in the analyzed posts.

In addition to human personalities, the environmental OLs illustrated different means of transport in ten images, including cars, electric cars, bikes, scooters, public transport, and boats. While scooters, bikes, or night trains were represented as heroes contributing to the sustainability transition in the transport sector, electric vehicles, thermic and diesel cars, and the transport sector, in general, were named as villains in the posts by environmental OLs in France. Electric cars are ambiguous in all the analyzed posts. On the one hand, they are represented as heroes who contribute to CC mitigation by reducing CO₂ emissions during exploitation. On the other hand, the environmental OL considered controversial information about battery production and recycling, as well as energy produced from fossil fuels used to power electric cars, harmful to people and nature.

The nature is underrepresented in the visual mode of the analyzed posts. The environmental OLs posted a few images of parks or landscapes as a background for their photos.

They highlighted in the captions the victim roles of nature, forests, insects, biodiversity, natural resources, and the planet.

Regarding the iconic signs considering the obstacles to CC mitigation, they did not usually reflect the barriers to pro-environmental action: Most of the obstacles in the analyzed posts were introduced in the verbal mode. For example, a post by @juienbayou from Figure 102 criticized the actions of the President of the country regarding the reduction of SUV advertisements. However, the obstacle and the villain in this memetic image are mentioned in the verbal mode – linguistic sign. In another post by @ecolo_mon_cul, demonstrated in Figure 103, the obstacle is visualized by a red FIAT car with the license plate “BULLSHIT.” The car itself is indirectly involved in the obstacle representation, as in the picture of the SUV behind Elon Musk from Figure 101. Nevertheless, the plastic sign of the car’s red color from Figure 103 can be related to the color of the brand’s logo, and at the same time, it may be associated with danger. Another element related to the obstacle is represented by a linguistic sign of a “BULLSHIT” text line on the license plate, which directly criticized the obstacle to CC mitigation – greenwashing by the automobile industry.



Figure 103 post by @ecolo_mon_cul, 24.03.2022

Different iconic signs of the posts represented environmental values. The images of parks and trees reflected biospheric values, as in the image posted by @julienbayou (Figure 104).

Although the image of green land and trees from Figure 104 reflected biospheric value, the text of the post (linguistic sign) emphasized the necessity to help agriculture workers to protect our future, “*Préserver ces terres agricoles, c’est préserver notre avenir.*”



Figure 104 image from a post by @julienbayou, 25.02.2021

Another image posted by @wdEjOy⁶⁶, reflected biospheric and hedonic values at the same time. Biospheric values are represented by nature in the background and by eco-responsible transportation, which does not produce carbon emissions. The hedonic value of this image represented enjoying life’s pleasures, such as traveling, which was demonstrated by the happy emotions of the post’s author.

⁶⁶ Pseudonymized account



Figure 105 image posted by @wdEjOy, 03.06.2021

Various compositions and colors from analyzed **plastic signs** alternated within the images and videos. The posts by politicians reflected dark colors such as grey, black, brown, and dark blue. The environmental OLs pursuing creative professions varied their color palettes to discuss transport-related issues. They used predominantly green and blue colors. In several posts, cream beige was used as a background for the textual information or infographics. We illustrated the analyzed images in Figure 106, which are sorted according to their colors with the help of *ImageSorter*.

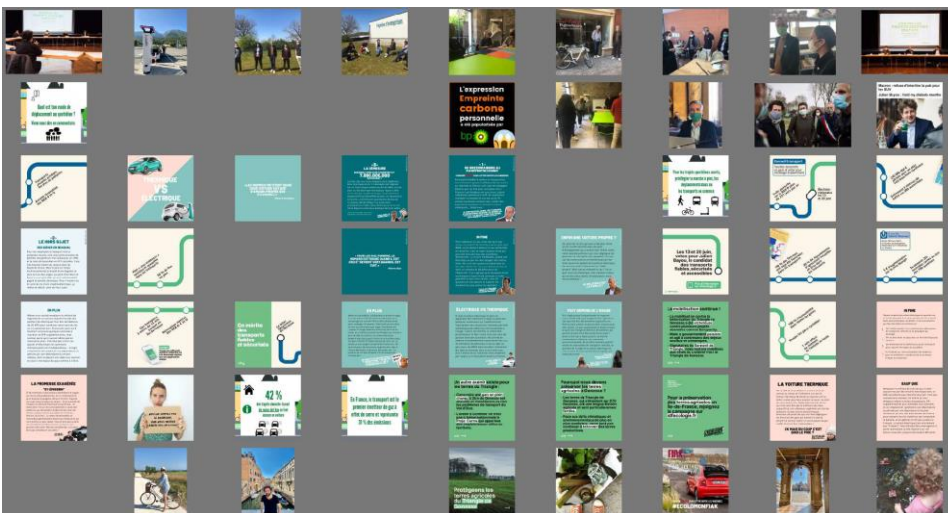


Figure 106 Visualization of 56 analyzed images from the corpus data, done with the ImageSorter V4

The dark blue, green, and brown clusters appear on the top of Figure 106. Many visuals with light colors are shown on the right and left sides in Figure 106. This Figure also illustrates the images containing verbal elements. In most cases, the verbal component of the image took a central position, contrasting with the picture or color on the background.

In addition to the red color of the car from Figure 103, another color can be associated with the obstacles to climate action – the black color. It was represented in one image as a background for the text, emphasizing the role of fossil fuel companies in the “popularization of personal carbon impacts.”



Figure 107 post by @pierre.larroutourou, 05.08.2021

Considering the **linguistic signs** of the posts, the images were frequently accompanied by the text within them. 44 out of 56 images (78,57%) included verbal elements, and all analyzed videos used either subtitles or other verbal components. Most dark-colored images included white text. This technique allowed the readers to focus on the verbal part of images. The text took a central position within the image. In many posts, the title was written in a larger font than other text. In addition to highlighted titles, some words were underlined within the text on the image using different background colors. All these techniques were to gain audiences' attention considering different solutions and problems in the sustainability transition.

In the analyzed posts concerning the transport sector, environmental OLs frequently discussed adapting individual car use to the sustainability transition. The most frequently used adjectives with the noun *voiture* were *électrique*, *individuelle*, and *petite*. The theme

considering trains discussed mostly night trains, *train de nuit*. The adjectives that accompanied the word *transport* were *fiable*, *confortable*, *sécurisé*, *sûr*. These words and phrases were predominantly represented as solutions to the sustainability transition in the transport sector.

The obstacles to CC mitigation and the related values in the analyzed posts were introduced preliminary in the verbal mode of all posts: the caption to the post and the text appearing in the image or video. While all of the posts presented at least one obstacle to CC mitigation, some posts combined the discussion of two obstacles, which were logically linked to each other. For example, the obstacle related to commonly discussed *Stereotypes* was closely connected to the obstacle category of *Money*. In one of the posts, the author wrote:

“Il y a quelques années, **on m’a sorti dans une discussion : « l’écologie c’est bien un problème de riches »**. A l’époque, je n’avais pas les chiffres (ni même le répondant) pour la repartie adéquate. **Mais en soit, oui c’est un problème de riches** : en 2019, les 10 % les plus fortunés de la planète ont pesé à eux seuls près de la moitié de toutes les émissions mondiales de dioxyde de carbone. Et habitant.e.s dans un pays occidentalisé, riche comme la France, on peut facilement être un.e occidental.e riche qui pollue donc (en théorie) beaucoup plus que le reste de la planète. Et dans ce sens, **il est de notre responsabilité de limiter notre impact en tant qu’individu** : et vu l’urgence, on n’a pas vraiment le temps de débattre de la responsabilité de l’individuel ou du collectif, il faut une action de l’ensemble des groups [...]”

In the example above, we may see an implicit form of talking about the obstacle, which contributes to climate inaction by other people, not the author herself. This is expressed by the phrase “**on m’a sorti dans une discussion : ‘l’écologie c’est bien une problème de riches’**.” Ecology as a problem of rich people is one of the stereotyping opinions in this social media discourse. Although the author somehow agreed with this statement, she emphasized the necessity of individual and collective actions – solutions further discussed in the post’s text. In this example, two categories of obstacles – *Stereotypes* and *Money* – are inter-connected.

In another example, *Organizing the action* and *State authorities (in)action* were intertwined. The OL stated that individual eco gestures could become useless if everybody looked at the other people and did not do the action. In addition to this, the author claimed that people needed political leaders to contribute to the CC mitigation. However, the actions of political leaders were not sufficient, and therefore, they contributed to the deceleration of CC mitigation:

“**Ils sont bien là, les dirigeants. Les gestes individuels c’est important et ça leur va si bien**. Ils n’ont rien à faire, tant qu’on se regarde les uns les autres[...] On a pas le temps

pour une croissance verte, le timing est serré. [...] **On n'a pas besoin que 7 milliards de personnes fassent des petits gestes puisque les deux tiers n'ont même pas la possibilité d'y réfléchir. On a besoin qu'une centaine de riches se bougent le cul.**"

Contrary to the attribution of responsibility and blame to politicians discussed by other enunciators, the politicians' scheme of the discourse about sustainable transport included: 1) introduction of the problem, 2) emphasizing that other politicians do not act for climate, 3) self-promotion by suggesting to solve the problem and proposing multiple solutions.

In some cases, the obstacles related to the *State authorities' (in)action* and *Actions of the companies* were generalized. According to the environmental OLs, politicians and companies acted wrong (villain role): They neither contributed to the solution nor specified any concrete actions. These (in)actions are related to the egoistic value of authority or social power. Indeed, according to the OLs, governments or companies do not use their authority and social power to contribute to CC mitigation, as demonstrated in two extracts from the posts below:

1. "Du fait de politiques publiques peu ambitieuses, ces projets exemplaires restent encore aujourd'hui difficiles à mettre en oeuvre."
2. "Nous avons un ennemi commun : les gouvernements et entreprises qui ne font rien face à l'ampleur mondiale du réchauffement climatique ☹️ C'est un fait, ce sont eux les responsables."

More contextualized obstacles in the posts included (1) expensive public transportation, which is not always convenient due to the delayed trains or busses, (2) not secure public transportation in particular because of the sexual aggressions of women, (3) lack of place in public transport, (4) useless infrastructures of public transports for certain districts, in particular in Paris, (5) excessively long travel by train for the same journey that can be done by plane, (6) too expensive public transport, (7) a large number of personal cars on the roads bothering those who use bikes as the main mean of transport. It should be noted that more contextualized or concrete obstacles were provided by environmental OLs who do not pursue a political career.

The values related to the obstacles expressed in the posts, as obstacles themselves, are always expressed in the verbal mode. The examples of contextualized obstacles in the paragraph above are closely related to egoistic and hedonic values. Indeed, people did not wish to spend much money on public transport, which can refer to the egoistic value category and wealth sub-category. In particular, this is because they do not always feel comfortable enough to use public

transport more frequently, which is directly related to the hedonic value and its comfort subcategory.

During the qualitative analysis, we observed that in some cases, the obstacles were introduced in the texts, including the conjunction “*mais*.” We used the *Sketch Engine* Concordance function to illustrate all sentences, including “*mais*.” Interestingly, the conjunction “*mais*” was used in 13 out of 17 analyzed posts’ captions. It was mainly used to clarify or explain certain information, as in the examples below:

1) [...] C’est une organization pour les étapes de charge **mais** si on fait des étapes cool (nous c’était Annecy) c’est plutôt agréable. [...]

2) [...] Compléter en commentaire ce dont nous ne sommes pas responsables **mais** sur lequel on peut agir [...]

3) [...] Nous avons évidemment notre petite idée **mais** nous avons aussi demandé aux habitant·es de Neuilly-sur-Seine ce qu’ils en pensent... Pour une région qui rénove et [...]

In the first example above, “*mais*” is related to a solution to a possible obstacle: The author discussed that organizing long-distance traveling by car could be exhausting, but better organization of the stops could mitigate this obstacle. Examples 1–3 demonstrated the most frequent uses of “*mais*” in the meaning *yet* and *only*, nevertheless, in two cases, “*mais*” related to the obstacles to CC mitigation described in the captions. Figure 108 illustrates the use of “*mais*” in the middle and beginning of the sentences discussing the obstacles. These obstacles are related to *State authorities (in)action* (line 1) and *Personal feelings and conditions* (line 2).

Details	Left context	KWIC	Right context
1	ainsi que des primes pour l'achat d'un vélo.</s><s>C'est un bon début	mais	c'est vraiment insuffisant ! 😞❤️ Ce qui me plait dans le projet de @julienbayou
2	, l'occasion et encore l'occasion, moins de bagnole et du troc.</s><s>	Mais	ça va toujours pas, j'ai la sensation de me trouver des excuses.</s><s>

Figure 108 Use in the context of the “*mais*” in the posts by environmental OLs in France considering transport theme, made with the Concordance function in *Sketch Engine*

In Figure 108, line 1 states that “IDF propose déjà un système de location avec @veligo_loc ainsi que des primes pour l’achat d’un vélo. **C’est un bon début mais c’est vraiment insuffisant !** 😞❤️ Ce qui me plait dans le projet de @julienbayou c’est de repenser le vélo comme une option”. In this message, the author emphasized already existing climate-friendly

initiatives, which, however, are not sufficient. In the end of the phrase, the author promoted a project of a member of the green political party. In fact, this message was a part of a regional elections political campaign.

Another example used ‘mais’ in the beginning of the phrase, line 2 of Figure 108 “[...] La diminution de la viande, la banque éthique, l’électricité verte, l’occasion et encore l’occasion, moins de bagnole et du troc. **Mais ça va toujours pas, j’ai la sensation de me trouver des excuses.** . 🧐 Je termine par me rappeler qu’il n’y a que les enfants [...]”. In this example, the OL described personal sustainable practices, yet highlighting certain psychological difficulty.

A synonym of “*mais*” – “*cependant*” – was also used to indicate an obstacle in one post. In the example below, the author underscored the necessity of environmental initiatives and eco-conscious activities. However, these efforts are insufficient to limit the planet’s temperature rise. With this post, the author identified insufficient outcomes from personal actions and emphasized the role of politicians in regulating the situation:

“Le saviez-vous ? L’idée d’une empreinte carbone personnelle a été popularisée par une grande campagne publicitaire de la société de combustibles fossiles BP en 2005, conçue par Ogilvy. [...] C’est pour cela que selon ce rapport, il est plus réaliste d’espérer une baisse de 10% de par nos changements de comportement. 🧐 **10 %, ce n’est pas rien et les #ecogestes doivent devenir la norme de nos comportements. Cependant,** selon ce même rapport, **cela ne suffirait absolument pas à maintenir la température terrestre sous les 2°.** [...] Toute politique visant à uniquement agir sur le facteur de la responsabilité personnelle est vouée à l’échec. [...]”

In the example above, the author attributed responsibility and the obstacle to a fossil fuel company, *BP*, which used their social power (implicit egoistic value) to popularize the idea of individual carbon impact. Although the author did not oppose individual pro-environmental action, he highlighted the importance of national policies in regulating CC mitigation.

To summarize, in this part, we discussed the iconic, plastic, and linguistic signs concerning the obstacles, values, and narrative roles that appeared in the posts about sustainable transport by environmental OLs in France. The iconic, plastic, and linguistic signs were intertwined in the analyzed posts. Identifying the obstacles, values, and narrative roles in the image could be impossible without the provided verbal explanation. This appearance of the text-on-image elements is a specific characteristic of our Instagram corpus. This verbal explanation appeared in the texts within the images and the posts’ captions. Using electric

vehicles as a possible but controversial solution was frequently discussed in the analyzed posts. In most analyzed posts, images illustrated the caption: They provided visual support to what has been discussed in the text. In other posts, the visuals were used to provide long-read arguments considering electric and non-electric vehicles. The major obstacles identified in the posts were related to the (in)action of the government, actions of transport or fossil fuel companies, and difficulties related to organizing the pro-environmental action. The significant values identified in the posts were biospheric and altruistic. In some cases, the egoistic and hedonic values were related to the obstacles. The *State authorities' (in)action* obstacle was more frequently associated with the egoistic value item of authority. In some examples, the environmental OLs attributed the egoistic value of wealth to insufficient financial resources of individuals to take long-distance trains and public transport in general. The hedonic value item of comfort can be associated with the problems appearing during the use of public transport: not secure public transportation in particular due to the aggressions or insufficient number of places in public transport.

7.2.3 Sentiment analysis of the comments

Sentiment analysis of the comments complemented content analysis and was used to identify the positive, mostly positive, neutral, mostly negative, or negative elements within the comments. We presented the analysis procedure in Section 4.3.3.2 *Sentiment analysis of the comments*. In this part, we focus on the results obtained by considering the comments to the posts by French environmental OLs about public transport and individual car use.

The sentiment analysis results of the comments demonstrated the prevalence of positive elements in the analyzed comments: Most analyzed comments were identified as positive and mostly positive: 70,81%. Negative or mostly negative comments were identified in only 16,26% of the comments. The results from the sentiment analysis are reflected in Table 40.

Table 40 Sentiment analysis of the comments to the posts by environmental OLs considering the transport sector in France

Bert_Sentiment	Number of comments	% of total
negative	49	7,53%
mostly negative	57	8,76%
neutral	84	12,90%
mostly positive	59	9,06%
positive	402	61,75%
Total	651	100%

In addition to the sentiment analysis of the comments, we combined the sentiment analysis results with the results obtained from the content analysis described in the next part. This crossing of the variables demonstrated that the positive comments identified during the sentiment analysis almost did not present obstacles in their texts. The obstacles to pro-environmental behavior appeared more frequently in the comments labeled by the tool as mostly negative, neutral, or negative (Figure 109).

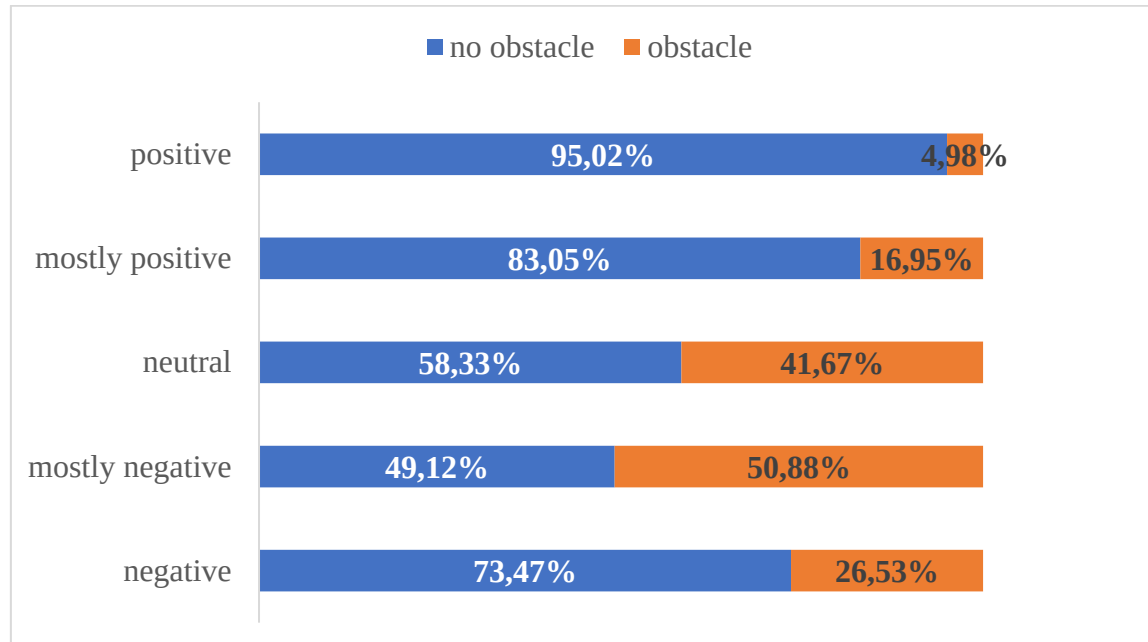


Figure 109 Sentiment-Obstacle relationship in the comments to the posts about transport transition in France

These results only partly confirm our **Hypothesis 3:**

The sentiment analysis of the comments will reveal messages, including obstacles to pro-environmental behavior or skeptical comments, which will be labeled as “negative” or “mostly negative.”

Although the obstacles appeared more frequently in the comments labeled as “mostly negative” (50,88%), a significant part of the comments containing obstacles was also identified as “neutral” (41,67%) or “mostly negative” (26,53%) comments, as illustrated in Figure 109. In this context, the sentiment analysis method demands further fine-tuning and validation. The limitations of the sentiment analysis method are discussed in detail in Section 8.2.2 *Limitations of data analyses*.

To summarize, the sentiment analysis of the comments to the posts by French environmental OLs regarding the use of public transport and cars revealed predominantly positive responses from the audiences. However, examining these comments alongside manually identified obstacles demonstrated a complex relationship between the obstacles and the identified sentiments in the comments. Although the majority of the obstacles appeared in the comments labeled as “mostly negative,” the comments containing obstacles were also identified as “neutral” or “negative.” This connection between the negative sentiments and obstacles should be further examined, and the sentiment analysis model demands further fine-tuning. In the next part, we draw particular attention to the obstacles, the values concerning the obstacles, and the narrative roles present in the analyzed comments.

7.2.4 Analyses of the comments

We applied content analysis to investigate the obstacles, values, and narrative roles in the comments. We explained the detailed analysis procedure in Section 4.3.3.3 *Content analysis of the comments*. In this part, we focus on the comments considering the transport sector in the French subcorpus of environmental OLs, specifically the comments to the posts regarding public transport and individual car use. We start by delineating different obstacle categories and providing examples of them. Where possible, we provide environmental values in relation to the obstacle category. Then, we introduce the observed narrative roles. We finalize this part by providing specific patterns and linguistic markers of the obstacle discourse.

Only 107 of 651 analyzed comments (16,44%) to the posts about the transport transition by environmental OLs in France included the obstacles to pro-environmental actions. These

obstacles were either directly or implicitly introduced in the comment's text. By directly communicating the obstacle, we understand clearly communicated obstacle to pro-environmental action by the enunciator. Implicit obstacles mean obstacles evoked or suggested indirectly by the enunciator. In some comments, we observed a combination of obstacles discussed by the author. The identified obstacle categories included organizing the action (47,41%), actions of other laypeople, feelings and individual conditions, state authorities (in)action, communication and knowledge, money, actions of companies, and COVID-19. Figure 110 illustrates the numbers of each obstacle category calculated as a percent of the total number of occurrences of the obstacles (N=116). In the following paragraphs, we provide different examples of each obstacle category. The orthograph of each example comment was not modified.

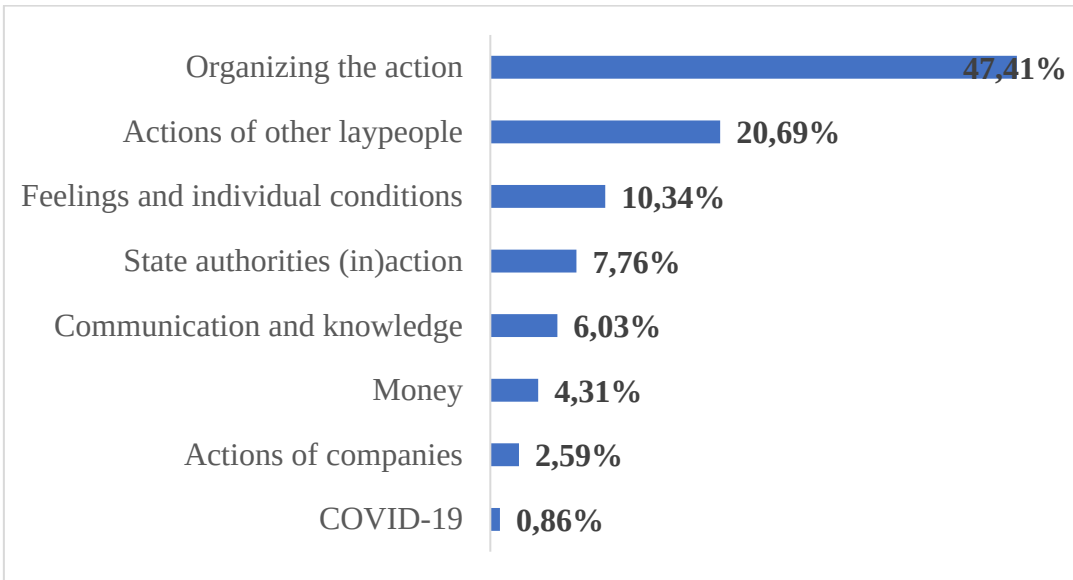


Figure 110 Categories of obstacles in the comments to the posts about the transport sector in France

Considering the transition to sustainability in the transport sector, the most frequently mentioned obstacles were related to the *Organization of the action*. These obstacles appeared in 55 comments and can be divided into several categories. The first category included problems related to public transport and its poor adaptation to the sustainability transition needs. This was illustrated by a lack of night trains for long-distance travel (comment A). Another category of observed obstacles reflected problems regarding the use of electric vehicles. Specifically, these obstacles are represented by nuclear waste from the energy produced to supply electric vehicles

(comment B), problems related to the recycling of electric vehicle batteries (comment C), energy use issues (comment D), the extraction of the rare metals to produce the batteries (comment E), and considering electric vehicle as an impractical solution (comment F). The last category of obstacles related to the organization of the action considered the global organization of the action. This *Organization of the action* can be linked to *Personal feelings and emotions*, i.e., when a person thinks that his actions are not sufficient on the global scale (comment G). In most cases, organizing the action obstacle was linked to the hedonic value of comfort, as in example A, where the author takes an airplane to travel to Venice since it is the most comfortable option for him. Another hedonic value can be observed in comment F, where the author claimed the impracticality of electric vehicle use.

A: Bien dommage que le train de nuit pour Venise n'existe plus, **ça incite à prendre l'avion, lorsqu'on ne conduit pas...**

B: Énergie électrique =centrales. On recyclé comment les déchets ?

C: Bonjour Cyril je faisais le même raisonnement jusqu'à ce que j'apprenne **qu'on ne savait pas quoi faire des batteries de voitures électriques...** 😊

D: Du coup l'énergie verte c'est comme les voitures électriques **ce n'est pas si top que ça** donc il faut juste rester avec une électricité normal en la consommant le moins possible ?

E: Et le nickel de la batterie ? Le cobalt ? On en parle ? Le problème du tout électrique réside dans les métaux qu'il faut extraire pour faire les batteries. Une fausse bonne idée.... [...]

F: Quand on sait que sur certains modèles de voiture électrique il faut changer les batteries au bout de 10 ans et que ça coute 8000 euros on revient vite à la voiture thermique qui tournera encore 20 ou 30 ans plus tard avec le même moteur et pour pas trop cher si c'est bien entretenu. **Alors les voitures électrique c'est bien pour les enfants qui jouent aux voitures télécommandés mais pas pour la vraie vie.**

G: [...] **nos petits gestes ne changeront pas le monde**, et d'autres continueront à souffrir de la pollution et de la misère... [...]

Actions of other laypeople as an obstacle were generally related to the actions of other people that could demotivate the enunciator to contribute to CC mitigation. These actions included aggressions in public transport, which forced people to stop using public transport, as demonstrated in examples H–I. This obstacle is directly related to the egoistic value item of

personal health: people decided not to take public transport since it is their safest option. In other comments, the actions of entrepreneurs like Jeff Bezos (comment J) or insufficient efforts by other people (comment K) were indirectly related to the obstacles to the sustainability transition in the transport sector. These insufficient actions can also be related to the egoistic value cluster, yet the comment's author attributed this to people unwilling to contribute to CC mitigation.

H: Au moins en voiture.. pas d'agressions sexuelles !!

I: Après plusieurs **agressions/harcèlements venant de la gente masculine dans les transports en commun**, j'ai définitivement fait une croix dessus et beaucoup de mes amies aussi.

J: [...] Et pendant ce temps, Jeff Bezos et ses acolytes milliardaires vont faire les glands dans l'espace... 🤔

K: Ça dépend de quoi on parle avec « petits gestes ». Si on parle de trier ses déchets, les réduire et prendre moins la voiture, **ok peut-être pour les 10% seulement**.

The category of feelings and individual conditions reflected an individual's emotions and conditions, contributing to low engagement in CC mitigation. These feelings can be described as struggle or *galère*, which can appear while doing the action mainly related to electric vehicle use for long-distance travel (comment L). Lack of time was mentioned in comment N as another obstacle considering personal conditions. Example M demonstrates a rather vague description of the obstacle related to personal feelings: the author stated that he could not do the action without mentioning a particular reason. Most of the obstacles in this category were related to hedonic values of comfort.

L: Bravo mais perso je le ferai pas. **Une galère sans nom** 😞

M: Un grand bravo car c'est nécessaire **mais** je n'arrive pas encore à franchir cette étape de supprimer l'avion

N: Moi j'ai pas osé faire mes 2300km À/R avec mon électrique. **Manque de temps** 🤔

The *State authorities (in)actions* were not frequently mentioned as obstacles in the comments, and they reflected mainly unwillingness to contribute to CC mitigation by political leaders (comment O) or impossibility of the sustainability transition due to the lack of "real ecological policies from the government" (comment P). Nevertheless, the authors of these comments did

not specify a particular policy to adopt. The egoistic value item of authority, which political leaders do not use to mitigate the effects of CC, can be related to this obstacle category.

O: **Malheureusement** tant que nos politiques seront ce qu'ils sont le changement, le vrai, ne viendra pas....

P: Je suis tellement d'accord avec vos dernières phrases. Et ça me met tellement en colère !!! Sans réelle politique écologique de la part du gouvernement et de ceux qui dirigent le monde, c'est mission impossible !

The analyzed comments indirectly evoked the problems related to *Communication and knowledge*. They considered a controversial issue of electric cars' pollution (comment Q), problems related to not understanding battery manufacturing (comment R), and controversial communication by ADEME regarding electric vehicles (comment S).

Q: Et peux tu nous dire Cyril en quoi les voitures électriques sont moins polluantes que les voitures thermiques à long termes stp ? **Question qui fait débat**

R: Je crois par rapport à la fabrication des batteries, extraction des «matériaux ». **C'est faux?**

S: @cyril_dion en 2016 l'adele publiait que sur l'ensemble de son cycle de vie, la consommation énergétique d'une voiture électrique était globalement proche de celle d'un véhicule diesel. Ce sans prendre en compte le coût écologique de l'extraction des métaux rares nécessaires et non comptabilisés mais catastrophique. **Qu'est ce qui a changé depuis l'étude de 2016 pour que l'ademe révisé cette position ?** (je précise je suis pas pro voiture diesel voire voiture tout court)

The *Money* category of obstacles entailed insufficient financial resources for eco-friendlier transport alternatives (comments U and V). In particular, one person highlighted the lower prices of airline tickets, which played a significant role for this person (comment T). This category of obstacles is directly related to the egoistic value cluster of wealth.

T: **L'avion est beaucoup trop bon marché**, par rapport au train

U: Très bonne idée...**mais** en terme de coûts, ça donne quoi ? **Tout le monde ne peut peut-être pas se le permettre**

V: Oui c'est très bien...**mais** bon un très grand nombre d'enfants de d'adultes n'ont pas plus pris l'avion que vous. **Un grand nombre de gens n'en ont pas les moyens.** Ceux qui polluent sont toujours les mêmes hein

Actions of companies as an obstacle to pro-environmental solutions were mentioned in a few posts and considered insufficient actions by a leading train company in France, SNCF (comment W). The egoistic value of social power, which the company does not use to contribute to environmentally friendly initiatives, can be related to this obstacle category in this comment. Another comment compared the “small efforts” of individuals to the actions that could have been done by industries (comment X), yet the actions of companies are mentioned indirectly in this comment. Moreover, comment X is solution-oriented: The author demonstrated personal examples of pursuing environmentally-friendly actions, such as consumption of local products, buying in bulk or second-hand, and being minimalistic.

W: Le train est une vraie solution et des initiatives citoyennes redéployent des lignes abandonnées par la SNCF notamment dans le sens Ouest-est comme Bordeaux-lyon, **mais le lobbying syndical SNCF ne voit pas ces initiatives d’un très bon oeil** ☹️

X: C’est clair que nos petits efforts du quotidien semblent dérisoires face à ce que pourraient faire les industriels. Tant pis, je continue qd mm le plus local, le plus en vrac, le plus d’occasion, le plus minimaliste qui m’est possible, en pratiquant la méthode des petits pas, pour pouvoir regarder mes enfants en face plus tard.

The *COVID*-related obstacle appeared in one comment only and was combined with insufficient government action to mitigate CC. At the beginning of the comment, the author underlined the necessity of small actions, which “are not sufficient but surely are better than nothing.” Nonetheless, the author explained that the pandemic has negatively influenced all spheres of life and was used as an excuse not to contribute to climate actions (comment Y).

Y: La mode du ZD, elle est bien présente. Mais je crois vraiment que les consciences changent, en France en tout cas, ds mon entourage en tout cas. **Ce n’est pas suffisant, c’est sûr, mais c’est mieux que rien.** Pour le reste, **j’ai l’impression que le Covid a tout stoppé, les gouvernements et le reste. C’est une bonne excuse pour ne rien faire.** Ils « ont d’autres chats à fouetter ». Le vrai changement viendra des industriels. Ils sont capables en plus, quand on voit que l’interdiction des pailles en plastiques a mis des années à passer alors qu’en 6 mois, ils avaient tous trouvé une alternative... je ne sais pas quel pourrait être le levier...

In addition to the identified obstacles, we observed an interesting phenomenon that considered communication and knowledge issues. The authors of 15 comments asked the environmental OL questions regarding electric vehicle use. Most of these comments were posted under a post

by @cyril_dion, sharing personal experience of long-distance traveling by an electric car (Figure 111).



Figure 111 post by @cyril_dion, 18.08.2021

The authors of the comments to the post above asked the environmental OL questions concerning the production and use of electric vehicles. These questions used a polite form of clarifying specific points. Question 1 below can illustrate this: *How polluting is the electric battery after and even during its manufacturing, and what impact does the extraction of raw materials have?* Another function of these questions was to ask for advice or suggestions, as in Question 6 below: *can you tell me which electric car you have?* These and several other examples of questions to an influential person are provided below.

Question 1: Cyril pensez vous vraiment que les voitures électriques sont la meilleure solution ? Que fait on ensuite des batteries ? Donnez moi votre avis je ne sais que penser .merci

Question 2: @cyril_dion est-ce que je peux vous poser une question svp? Quelle est la pollution de la batterie électrique après et même de sa fabrication et de l'impact de l'extraction des matières premières ?? Merci de votre retour. Et merci pour tout votre travail 🙏🙏

Question 3: Bravo ! Petite question en passant, je m'interroge sur le recyclage des batteries des voitures électriques. Est ce qu'à plus long terme c'est toujours une solution préférable ?

Question 4: Et peux tu nous dire Cyril en quoi les voitures électriques sont moins polluantes que les voitures thermiques à long termes stp ? Question qui fait débat

Question 5: Du coup l'énergie verte c'est comme les voitures électriques ce n'est pas si top que ça donc il faut juste rester avec une électricité normal en la consommant le moins possible ?

Question 6: Bonjour @cyril_dion , **pouvez vous me dire quelle voiture électrique avez vous ?** Je vous remercie.

Regarding the narrative roles, heroes are underrepresented in the comments: They included everybody or “us,” all people, and “myself.” Although some industries, such as fossil fuels or nuclear energy, were criticized for their harmful actions, several comments indicated an essential role of industries' actions in overcoming the obstacles to CC mitigation.

We identified a significant number of villains in the comments, which can be divided into individuals, group entities, and things and concepts. The individuals mentioned as responsible for harmful actions were “you,” the author of the post or the comment, CEOs of companies Jeff Bezos (CEO of Amazon), politicians, influencers, and polluters. The main entities that were criticized for their irresponsible actions in the comments were the government, petrol lobbies, and SNCF. Things and abstract subjects as villains included nuclear energy, pollution, batteries, rare metals, communication, electric cars, hybrid cars, and industries.

The victims in the comments were mainly represented by children, “myself,” the author of the comment, people in general, poor people, and women. The non-human victims mentioned in the comments containing obstacles were nature and environment.

After carefully observing the comments containing the obstacles to pro-environmental action, we listed words and phrases as markers of such discourse. These markers included such words as *mais*, *quand même*, *même pas*, *même*, *malheureusement*, and *problème*. They are highlighted in red in the example comments above in this part. To see the use of these phrases in context, we effectuated the *Sketch Engine* Concordance function on comments containing obstacles. This function of the conjunction *mais* allowed us to visualize eight examples of the same pattern, including this conjunction, while discussing the obstacle to pro-environmental action (Figure 112). All examples from Figure 112 have a similar pattern to introduce an obstacle: “C’est [...] **mais** [...].” The visualized obstacles are related to personal feelings and conditions (lines 1,2), other people’s actions (lines 3 and 4), and organizing the action (lines 5–8).

Details	Left context	KWIC	Right context
1 ① onne route et stockez les batteries dans votre jardin Un grand bravo car c'est nécessaire		mais	je n'arrive pas encore à franchir cette étape de supprimer l'avion "Bravo 🙌 Bien domn
2 ① s'occuper de l'éducation des enfants, s'impliquer dans la vie politique etc... C'est pratique		mais	je me pose la question.</s><s>En Italie l'électricité est pas trop décarboné, donc entre le
3 ① it 3 A/R Paris New York ...On ne se chauffe plus ?</s><s>L'écologie en théorie c'est bien		mais	elle se heurtera au social de ceux qui ne peuvent faire autrement.</s><s>Qui ne sont pa
4 ① on des minerais pour la batterie non recyclable on en parle ?</s><s>Oui c'est très bien...		mais	bon un très grand nombre d'enfants de d'adultes n'ont pas plus pris l'avion que vous.</s>
5 ① ans le nucléaire.... Et qu'est-ce qu'on fait des batteries ?</s><s>C'est une belle initiative		mais	la fabrication des véhicules électriques est très polluante... en métaux notamment.</s><s>
6 ① is sérieux à l'époque, la voiture électrique n'aurait jamais vu le jour.</s><s>C'est pas mal		mais	je trouve dommage de mettre autant en avant les véhicules électriques alors que c'est pli
7 ① profiter de Venise et de passer de très bonnes vacances.</s><s>C'est bien beau tout ça		mais	ce n'est clairement pas la solution.</s><s>D'une part la tuture électrique est un à côté de
8 ① atteries ???</s><s>C'est un leurre tout ça et un enoooooorme !!!!!</s><s>super initiative		mais	on le sait le lithium vient bcp d'afrique transporté en chine pour des batteries de véhicules

Figure 112 Use in the context of the conjunction “mais,” made with Concordance function in Sketch Engine, comments data about transport in France

Quand même, même, or même pas were used as opposition markers in certain comments linking different aspects of electric vehicle or public transport use, which, however, are not the best solutions, according to the authors of the comments (Figure 113). The obstacles with these markers referred to communication and knowledge (lines 1, 4) and organizing the action (lines 2, 3, 5, 6, 7).

Details	Left context	KWIC	Right context
1 ① iel dans le métro manque de clarté et de compréhension.</s><s>C'est		même	douteux.</s><s>Bref, vous êtes comme tout le monde à mon grand re
2 ① que vous avez consommé .) Pas si écologique que ça, hein ?</s><s>		même	pas du tout.</s><s>On en reparle quand vous lui aurez mis 150 000 kr
3 ① voiture diesel voire voiture tout court) La voiture électrique n'est quand		même	pas la solution...Il faut faire baisser les prix des billets de train...Les bat
4 ① avec les étapes hôtel le coût est comment ?</s><s>Je me pose quand		même	la question quant aux composants des batteries , leur lieu de fabricatio
5 ① outiens pour faire des forages aux Groenland l</s><s>Super l</s><s>		Même	pas en rêve je prendrai ces voitures... escroquerie Bravo vraiment !!</s>
6 ① ans les transports?</s><s>Recyclage des batteries désastreux quand		même	non?</s><s>L'avion est beaucoup trop bon marché, par rapport au trai
7 ① .Même expérience cet été en voiture électrique.</s><s>Réseau quand		même	pas très au point ... il faut être patient 😊 Avec nos enfants, même déc

Figure 113 Use in the context of “même,” made with Concordance function in Sketch Engine, comments data about transport in France

Malheureusement appeared five times in the corpus of comments; in all cases, it was related to the obstacles. The example phrases with this marker concerned *Organizing the action* (lines 1, 4), *Communication and knowledge* (line 2), *Money* (line 3), and *State authorities (in)action* (line 5).

Details	Left context	KWIC	Right context
1 ①	métaux notamment </s><s>Le Chili en souffre d'ailleurs. </s><s>	Malheureusement	il n'y a pas d'énergie propre </s><s>Grosse question aussi chez i
2 ①	iant l'impact environnemental de la voiture électrique </s><s>Car	malheureusement	la communication sur cette technologie ne fait généralement pas
3 ①	e, à quand les trains moins chers que les avions aussi parce que	malheureusement	c'est pas toujours le cas. </s><s>Les bus par contre niveau prix c'
4 ①	</s><s>La non-utilisation des infrastructures existantes est aussi	malheureusement	un argument de poids pour que les politiques décident de les faire
5 ①	électricité normal en la consommant le moins possible ? </s><s>	Malheureusement	tant que nos politiques seront ce qu'ils sont le changement, le vra

Figure 114 Use in the context of “malheureusement,” made with Concordance function in Sketch Engine, comments data about transport in France

A noun *problème* was used in several comments to highlight the obstacles or villains discussed. These obstacles referred to the *Organization of the action* (lines 2, 3, 4, 5, 6, 7 in Figure 115). The villains as problems were us – people – and are demonstrated in line 1 of Figure 115.

Details	Left context	KWIC	Right context
1 ①	plus car non rentable l</s><s>Je pense plutôt que Nous sommes le	problème	en tant qu'individu, consommateur, habitant des villes ou des campag
2 ①	el de la batterie ?</s><s>Le cobalt ?</s><s>On en parle ?</s><s>Le	problème	du tout électrique réside dans les métaux qu'il faut extraire pour faire
3 ①	es et je vous admire.</s><s>Mais quid de l'énergie grise ?</s><s>Le	problème	des batteries (durée de vie, matériaux et énergies nécessaires ...) ?</s><s>
4 ①	bilans attif car le bilan CO2 est biaisé et il ne prend pas en compte le	problème	des terres rares dont la voiture électrique est un vrai gouffre. </s><s>
5 ①	ce qu'il faudrait vraiment.</s><s>Les solutions d'aujourd'hui sont les	problèmes	de demain...au-delà de ce qu'il se passe actuellement déjà avec les n
6 ①	pe alors qu 'on détruit ailleurs- moyen - Bonnes vacances.</s><s>Le	problème	avec les véhicules électriques, c'est rapport aux batteries, il faut du lit
7 ①	SUV, plus polluant que les citadines thermiques... En France, le seul	problème	de l'électrique est la batterie. </s><s>Faut ajouter également les nuis

Figure 115 Use in the context of “problème” made with Concordance function in Sketch Engine, comments data about transport in France

Besides the markers of obstacles, we visualized the modifiers of train and voiture from the corpus of comments containing obstacles. The trains in this corpus were described as *inabordable*. The cars as *électrique*, *thermique*, *individuel*, *diesel*, *hybride*. The unaffordable trains reflected the money obstacle category related to the egoistic value item of wealth.

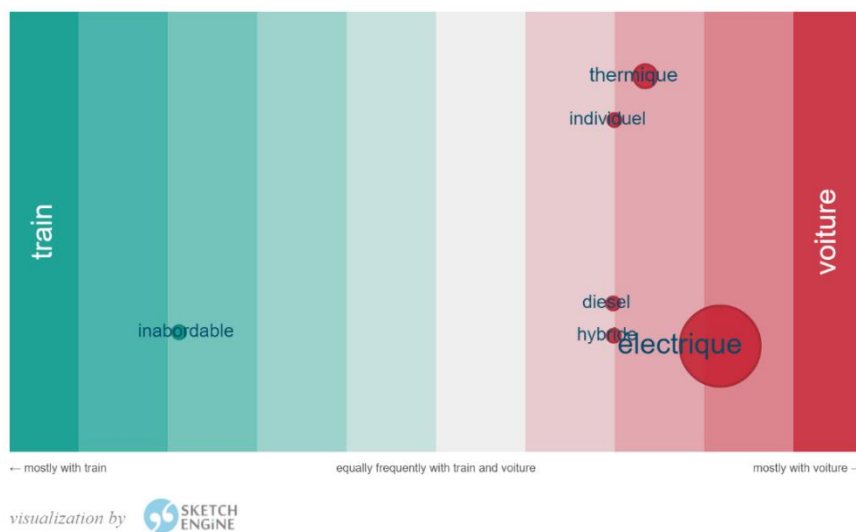


Figure 116 Word Sketch difference between “train” and “voiture,” made with Sketch Engine

To conclude this part, we conducted a mixed-method analysis of the comment data to investigate the obstacles to pro-environmental behavior, values related to these obstacles, and narrative roles. The obstacles related to the organization of the solution to CC mitigation were the most frequently discussed in the comments. This organization mainly referred to the manufacturing of batteries for electric vehicles, which is not considered an environmentally friendly solution, or the problems related to traveling by train. The heroes and victims are not frequently present in the analyzed comments. However, the role of victims was represented by various individuals, groups entities, and objects or concepts. In addition, we observed several markers that can be related to the obstacle discourse: *mais*, *quand même*, *même pas*, *même*, *malheureusement*, and *problème*.

7.2.5 Discussion and summary of the results

In this part, we summarize and reflect on the results from our mixed-method study of Instagram posts and comments to them concerning the individual car and public transport use discussed by French environmental OLs in January 2021–March 2022. Unlike the other case studies, the communication regarding public transport and individual car use was investigated by analyzing the posts of environmental OLs only since the obstacles to the transition in this sphere appeared predominantly to the posts by environmental OLs. To investigate this data, we applied multimodal discourse analysis in combination with computer-assisted linguistic analysis to the

posts and a three-method approach to investigate the comments: sentiment analysis, content analysis, and computer-assisted linguistic analysis. This combination of multiple methods allowed us to overview the multimodal data in a broader sense and to provide specific trends and patterns regarding the obstacles to pro-environmental action, environmental values concerning these obstacles, and narrative roles that appeared in the posts and the comments.

Regarding the observed iconic signs, not many images of transport were present in the corpus data, although the central theme of the posts was the sustainability transition in the transport sector. Indeed, the images more frequently illustrated the portraits of politicians and infographics. In general, the OLs posted still images. Video content considering transport sustainability is not frequent.

The environmental OLs predominantly used two types of images in their posts. First, they used visuals as illustrations or proof images to the texts of the posts. As in the typology of visuals by Catellani (2018), the illustrations were mainly represented by personal photos (including ethos images) or photo reportages from specific events. A set of typical illustrations in our corpus is demonstrated in Figure 117. Interestingly, the illustrations generally obtained the highest engagement rates, i.e., numbers of likes and comments in relation to the total number of account's followers, compared to other types of images. These realistic images are closely related to authenticity on social media (Hund, 2023). In marketing research, Shoenberger et al. (2020) argued that authenticity on social media may not necessarily lead to an increased engagement rate; however, it can improve attitudes towards a brand or an influencer.



Figure 117 Visuals as illustrations in the posts considering transport theme by environmental OLs in France

The second category of typical images posted by environmental OLs in France considering the sustainability transition in the transport sector included educational or informative texts on images and infographics, which can be called knowledge images (Catellani, 2018). Green and

blue colors were frequently used for knowledge images, which may stimulate aesthetic pleasure (O'Neill, 2017). A set of typical knowledge images from this subcorpus is illustrated in Figure 118.



Figure 118 Knowledge images in the posts about transport by environmental OLs in France

Although infographics can be typical for climate scientists' communication (M. Schäfer & Xiaoyue, 2023), our data demonstrated the frequent use of this type of visuals by environmental OLs who are not necessarily scientists. Some infographic images included ironic stickers portraying the comic faces of politicians, celebrities, or activists to discuss the differences between electric and thermic cars, which may be understood as a sarcastic or memetic form of communication. However, this humorous form is not characteristic of infographic images and is more related to rhetoric images, as suggested by Catellani (2018).

The observed plastic signs of the multimodal documents demonstrated a presence of dark brown, grey, and black colors. Nevertheless, green is also largely present in the images, which may be associated with nature and biospheric value in general. The composition of the visuals included text as a central element in the majority of the posts. Although obstacles to CC mitigation were observed in iconic or plastic signs in a few examples, it would be difficult to identify the obstacle within the image without the present linguistic signs. This leads us to an essential role of combination or intersection of multiple signs within an Instagram post to communicate about sustainability transition in the transport sector in France and confirms our **Hypothesis 2:**

The obstacles will be more clearly stated in the verbal mode of the posts, i.e., captions or text-on-image elements, on Instagram.

Contrary to the previous studies on media visuals (O'Neill, 2020), all analyzed posts and the majority of the images in this subcorpus were solution-oriented. The post's main scheme can be represented as 1) presenting a problem, 2) highlighting the villains, 3) proposing solutions,

and 4) inviting to discuss the solutions in comments. A similar pattern was previously observed in French and Dutch newspaper articles communicating about COP meetings (Dirikx & Gelders, 2010). In our case study, these solution-oriented posts generally highlighted biospheric or altruistic values, which, according to Bouman et al. (2021), could motivate engagement in climate action.

Environmental OLs, who are also politicians, tended to introduce every possible solution to the CC crisis at the same time: They presented multiple solutions in one post without explaining them but at the same time criticizing other politicians for their inaction. This communication was aimed at persuading audiences to support Green Party candidates for regional elections in France and can be considered a typical form of communication for such political campaigns (Benoit, 2007). Although discussing solutions to CC mitigation can be an effective communication strategy (Corner et al., 2015), such mix of ideas could confuse their readers.

In general, the environmental OLs in France and their audiences mentioned everybody, all people, or themselves as heroes for sustainability transition in the transport sector, underlining the importance of collective action. While the heroes and victims are underrepresented, the lists of villains in the posts and comments are diverse and include various individual or group actions, objects, or concepts. In Figure 119, we summarized the narrative roles (villains, victims, and heroes) attributed to different actors in the posts and the comments. While politicians frequently utilized individual responsibility as an important factor in the sustainability transition in the transport sector (Flipo et al., 2021), the authors of the comments to Instagram posts, in our case, frequently criticized this political discourse and emphasized a collective responsibility which is mainly addressed to the governments and industries.

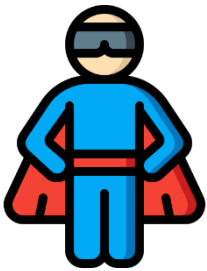
			
Posts	Myself, We, all people, activists, government, electric cars, night trains, politicians (Julien Bayou), train companies, scooter, bike	My children, us, people, citizens, planet, nature, bike, non-motorized transport, forests, insects, natural resources, biodiversity	electric vehicles, thermic cars, diesel cars, politicians (Emmanuel Macron, Valérie Pécresse, Jean-Luc Moudenc), Elon Musk, rich people, governments, the transport sector, fossil fuel companies (BP), companies
Comments containing obstacles	Everybody, industry, myself, “on,” we, us	children, environment, myself, nature, people, poor countries, poor people, women	you, people, they, politicians, government, influencers, CEOs of companies (Jeff Bezos), petrol lobbies, nuclear energy, pollution, polluters, SNCF, batteries, rare metals, communication, electric cars, hybrid cars, industries.

Figure 119 Narrative roles in the posts considering public transport and individual car use by environmental OLs in France

As in the study of Wagener (2024), using electric cars was considered a controversial solution to CC mitigation in the posts by environmental OLs and in the comments to these posts. Overall, the obstacles to pro-environmental action in the comments differed from the obstacles in the post. The obstacles in the posts were related to the (in)action of the government, the actions of transport or fossil fuel companies, and the organization of the action. In the comments, however, the (in)actions from the government took a marginal role. The major obstacles in the comments referred to the organization of the action, actions of other laypeople, and feelings and individual conditions. The obstacles related to the organization of the action were, in some cases, attributed to the industries or administrations in the comments.

The sentiment analysis of the comments revealed predominantly positive comments, which correlates with a relatively small number of comments containing obstacles: 16,44% of all comments included obstacles. The majority of the obstacles appeared in the comments, which were labeled mostly negative, neutral, or negative. Only in 21% of comments labeled by

sentiment analysis as positive and mostly positive, we observed different obstacles to CC mitigation. Therefore, we cannot fully confirm our **Hypothesis 3**:

The sentiment analysis of the comments will reveal messages, including obstacles to pro-environmental behavior or skeptical comments, which will be labeled as “negative” or “mostly negative.”

For future studies, the proposed sentiment analysis method can be fine-tuned to provide better accuracy in identifying obstacles.

As discussed in Section 1.1.3 *Climate change mitigation: French context*, the French government contributes to achieving SDGs by proposing different policies such as improvements in public transport infrastructure (Reigner & Brenac, 2019). However, the problems related to infrastructure, feelings of insecurity in public transport, and unaffordable prices of train tickets for long-distance travel were seen in comments as significant barriers to the widespread adoption of pro-environmental actions.

Our outcomes can also be compared to the results from survey data of 2001 French citizens conducted by Destin Commun in February 2023. The report by Destin Commun evaluated French perceptions and behaviors regarding low-carbon mobility, including individual car usage and attitudes towards electric vehicles, electric bikes, and public transport. Despite growing awareness of the climate crisis, many French individuals view car ownership as a fundamental aspect of their lifestyle and personal identity. Half of the French people said they preferred individual modes of transport rather than collective ones because they do not like traveling with other people. In addition, a perception of autonomy and freedom while driving outweighed concerns about environmental impact (Nervaux & Guerra, 2023). Similar opinions were observed in the analyzed Instagram posts by environmental OLs in France and their comments. For most people, individual car use was a part of everyday routine, mainly due to the practicality of this means of transport and the feeling of independence from other conditions. These factors may be linked to obstacles concerning personal habits introduced earlier in sociology research by Rocci (2017).

As in the study by Nervaux and Guerra (2023), we observed a notable skepticism towards electric vehicles in the analyzed posts and the comments, with a significant portion of the comments expressing doubts about their long-term sustainability and environmental benefits. This skepticism is influenced by perceptions that electric vehicles may not be as environmentally friendly as advertised, which is directly related to biospheric value. Besides,

the concerns about electric vehicle affordability and practicality for everyday use were another demotivating argument to adopt this practice, which can be linked to egoistic and hedonic values: egoistic – because financial resources are important for a person, hedonic – because of the impracticality of the proposed solution. Nevertheless, some comments from our data demonstrated an interest in the potential of electric vehicles by asking the environmental OLs specific practical questions regarding the use of electric vehicles. Our results or the comments' analysis are not that far from the outcomes provided by Destin Commun, where French citizens highly criticized the use of electric vehicles, but a majority of French individuals (60%) expressed a desire to purchase an electric car, yet mentioning affordability as a barrier to acquisition (Nervaux & Guerra, 2023).

In our data, one environmental OL criticized the government's decision not to ban the advertising of polluting vehicles in one of the posts; the comments to this post generally supported this idea, as well as the ban on purchasing SUV cars. The survey results by Destin Commun demonstrated a similar tendency: 53% of respondents favored banning advertising for polluting vehicles (Nervaux & Guerra, 2023).

An interesting position was attributed to the transportation companies and automobile manufacturers. On the one hand, they were considered villains since they produced polluting vehicles or used greenwashing techniques to promote them, particularly the FIAT company, in our data. On the other hand, the authors of the comments demanded that automobile manufacturers offer less polluting and more affordable vehicles; in this case, the companies can be considered potential future heroes.

Public transport was negatively perceived in the analyzed comment data to Instagram posts by environmental OLs in France. This is due to security issues, lack of financial resources, and organization of such travel. The barriers regarding the practicality of transport were mainly related to the insufficient transport supply, the prices for long-distance travel by train, and costly transport in Île-de-France. These obstacles are related to the hedonic value item of comfort and the egoistic value item of wealth. A report by Destin Commun showed that the negative perceptions of public transport were mainly expressed by people who do not use this means of transport, while frequent users of trains demonstrated a relatively positive image of public transport (Nervaux & Guerra, 2023).

Besides the obstacles directly related to the transport sector, the comments in our study revealed problems concerning communication and knowledge issues. This finding aligns with

a previous study by Rocci (2017), who claimed that “there is a real lack of knowledge about alternatives to the private car”⁶⁷ (Rocci, 2017). Although different media sources – news websites and platforms, podcasts, or television – frequently cover sustainable transportation, the comment data from our case study demonstrated a lack of particular knowledge about electric vehicles yet accompanied by curiosity to learn about the subject. In this case, the environmental OLs are seen by their audiences, i.e., people who respond to their posts, as experts or trustful individuals.

In several comments considering sustainability transition in the transport sector, we observed the appearance of nostalgic feelings among the audiences. For example, one person wrote:

“Mes parents de 60 et 63 ans n’ont jamais pris l’avion de leur vie. La société a changé, mais **parfois certaines habitudes que nous n’avions pas dans les 80’s étaient finalement une bonne chose**. Comme quoi, on peut s’en passer ! 🙄👉”

In this comment, the author did not suggest any obstacle to CC mitigation and highlighted the nostalgic feeling of “it was better before when there were no airplanes.” In earlier works, nostalgia concerning CC was identified in relation to climate visuals by Doyle (2009) or in Swedish media articles by Höijer (2010). In combination with other emotions, such as fear, hope, or guilt, nostalgia “may result in people caring about climate change” (Höijer, 2010, p. 728). In more recent research, nostalgia was mentioned as a significant factor in fostering sustainable consumption choices since nostalgia represents a potential to facilitate such decisions by subtly mitigating the inherent tension between individual and collective interests in decision-making processes, facilitated by an augmented perception of interpersonal connectivity (Vo & Manchanda, 2023).

To recapitulate, the analyzed posts considering transport sustainability by environmental OLs generally followed a pattern of presenting a problem, highlighting villains, proposing solutions, and inviting discussion. We identified two main tendencies in visual communication about transport transition: illustrations and knowledge images (Catellani,

⁶⁷ Translated from French by Yuliya Samofalova. The original text: “il apparaît un réel manque de connaissance des alternatives à la voiture individuelle” (Rocci, 2017)

2018). Among the illustrations, many images included ethos images, illustrating different personalities, oftentimes the OLs. The representation of obstacles, values related to them, and the narrative roles are incorporated in the iconic, plastic, and linguistic signs of the Instagram posts. In their posts, the environmental OLs mentioned insufficient government action as a major obstacle to CC mitigation. In the comment data, the most frequently discussed obstacles were linked to the organization of the proposed action. In the majority of the posts and comments, the obstacles to pro-environmental efforts were linked to egoistic and hedonic environmental values, which confirms our **Hypothesis 1**:

The obstacles to pro-environmental behavior in both posts and comments to them will be predominantly referred to the egoistic or hedonic values.

Although the environmental OLs and their audiences discussed obstacles to CC mitigation, these obstacles are not numerous in comparison to the number of analyzed data. The sentiment analysis revealed obstacles in the negatively labeled comments, which can represent a potential for future studies based on a significant number of short texts to identify the obstacles to pro-environmental action. However, the accuracy of this method needs to be improved for future research. The posts and comments are solution-oriented, and both the environmental OLs and their audiences demonstrated a willingness to adopt low-carbon mobility solutions. The role and the difficulties of communication and knowledge about CC actions were highlighted in the comments predominantly. Since environmental OLs are perceived as experts and trustworthy individuals by their audiences, we suggest collaboration with these individuals as a key element for environmental initiatives. More practical recommendations concerning communication about the sustainability transition in the transport sector are discussed in Section 8.3.1 *Implications for communication practitioners*.

7.3 Case study 3: Communicating about sustainability transition in the energy sector in Belgium

In this part, we propose a combined mixed-method case study addressing the multimodal data of the Instagram posts considering the transition from fossil fuel to renewable energies shared by Belgian environmental OLs and OLOs on Instagram. We start by presenting the corpus data. Then, we provide the results from a multimodal discourse analysis of the posts combined with computer-assisted linguistic analysis to provide a better picture of specific phenomena. In the third part, we discuss the results of the sentiment analysis of the comments. Section 7.3.4

Analyses of the comments concerns the results obtained from content analysis combined with computer-assisted linguistic analysis of the comments. Section 7.3.5 *Discussion and summary of the results* synthesizes and reflects on the analyses results of the selected posts and the comments to them.

7.3.1 Selected data

To investigate the communication about the sustainability transition in the energy sphere in Belgium, we selected the posts by OLs and OLOs from the *Corpus21-22_FET* obtained from an automated content analysis (cf. Section 4.3.1 *Automated content analysis*) and multimodal content analysis (cf. Section 6.1 *Belgium*). These posts introduced solutions or actions to climate change mitigation in the energy sphere since the obstacles to pro-environmental action were largely discussed in the posts regarding this sector. In particular, we selected posts that communicate about the transition from fossil fuels to renewable energy sources since the most significant number of obstacles appeared in these posts. In this part, we provide a report on the selected data.

In total, we selected 67 posts, which included 115 media files consisting of 98 images and 17 videos posted by environmental OLs and OLOs. The individuals tended to post more media files in one post, with the mean number of images per post equal to 2 compared to 1,28 images by the organizations. These statistics are presented in Table 41.

Table 41 Corpus of posts regarding the energy transition by environmental OLs and OLOs in Belgium

	Posts analyzed	Number of images	Number of videos	Mean number of images per post	Mean number of videos per post
OL_BE	17	34	6	2	0,35
OLO_BE	50	64	11	1,28	0,22
Total	67	98 (85%)	17 (25%)	1,46	0,25

In general, individuals and organizations posted predominantly images as media content: images are present in 85% of the posts by both individuals and organizations. However, the highest number of posted images within one post by the organizations is 6, and by the individuals is 8. As a rule, the posts by individuals and organizations either included images or videos. Only one post by an environmental OL represented an exception, which comprised four images and one video.

During the data collection stage, we also obtained 258 comments to the selected posts by OLOs and OLs. Before analyzing the comments, we cleaned the data by deleting mentions and links to other resources that do not possess any emotional function. We also deleted the duplicate comments posted by the same person to the same post. Overall, we obtained 239 clean comments ready for the sentiment analysis (Table 42). After having effectuated content analysis, we discovered that only 17% of the comments contained obstacles within them (Table 42). The detailed content analysis results are further discussed in Section 7.3.4 *Analyses of the comments*.

Table 42 Comments data to the posts about energy transition by Belgian OLs and OLOs

Type of account	Comments collected	Comments cleaned	Comments with obstacles
OL	145	132	26 (20% from cleaned)
OLO	113	107	15 (14% from cleaned)
Total	258	239	41 (17% from cleaned)

The detailed analysis procedures are provided in Section 4.3.3 *Case studies' analyses: a mixed-method approach*. In the following sections, we outline the results.

7.3.2 Multimodal discourse analysis of the posts

To understand how the obstacles, values, and narrative roles regarding the transition from fossil fuels to renewable energies in Belgium were represented in the analyzed posts, we conducted a multimodal discourse analysis of 67 selected posts by environmental OLs and OLOs. The analysis grid and detailed procedure are provided in Section 4.3.3.1 *Multimodal discourse analysis of selected posts*. In the following paragraphs, we discuss the analysis results following the analysis grid: first, we discuss iconic signs; second, we introduce plastic signs; third, we highlight the linguistic signs.

Attribution of responsibility and blame was a central theme of the posts by individuals and organizations. They blamed political actors for their wrong actions regarding the taxonomy plan, leaders of fossil fuel companies for continuous contribution to the high level of CO2 emissions, and banks for providing financial support to the fossil fuel companies. Specifically, a series of posts by XR Belgium explained wrong investments made by different banks in Belgium, e.g., Deutsche Bank and BNP Paribas. Other themes of the posts included general

information about energy transition concerning CC mitigation, consequences of Russian influence and war in Ukraine on the energy sector, proposing solutions to the climate crisis, and climate activism. The climate activism theme included motivating other people to spread the information, participate in climate strikes and protests, and join the climate movement.

Regarding the **iconic signs**, i.e., what is represented in the post and what it signifies, individuals tended to post more personal images, showing personal examples of contributing to climate action or just supporting a text with a personal photo. In fact, people of different ages and professions appeared in the greater part of the visuals. They were shown during the protesting action or environmental campaign (in particular by the posts of environmental movements), at governmental meetings (as reports by politicians about their achievements), at home in their natural environment, or as icons of blamed individuals or as a part of a meme.

Nature is underrepresented in the analyzed visuals. We observed some pictures of the sea, city parks, and landscapes. Several images illustrated stereotypical images of nature about CC, such as glaciers or polar bears, which were a part of Greenpeace's campaign to raise awareness about CC.

The iconic signs in relation to the energy sector were represented by fossil fuel pipes, constructions, emissions from fossil fuels, and renewable energies, such as solar panels and windmills. While renewable energies were seen in the majority of cases as heroes or solutions to CC mitigation, fossil fuels played the role of villains. Specifically, fossil fuels and nuclear energy themselves (mentioned in the texts and visualized by emissions polluting the environment) were considered harmful to nature, the environment, and future generations. The development of fossil fuels supported by companies and the government was frequently seen as an obstacle to CC mitigation by the environmental OLs and OLOs. This obstacle was mainly visualized by fossil fuel infrastructures or energy plants in the posts' visuals and complemented by the posts' texts (linguistic sign). Fossil fuels negatively influenced nature protection and prevention of pollution, which can be linked to biospheric values. Figure 120 illustrates several typical examples of fossil fuels observed in the analyzed visuals.



Figure 120 Fossil fuels in images posted by environmental OLs and OLOs in France

Other entities observed in the images can be referred to as villains in the analyzed posts, such as energy companies (mentioned in the texts, visualized with their logos, portraits of leaders), the EU (mentioned in the texts or captions to visuals), media (screenshots of media articles, citing media in a verbal mode within the visuals and the caption), politicians (image of political leaders, photos from other political meetings). We demonstrate several examples of the proposed villains in Figure 121 below.



Figure 121 Villains in the visuals to the posts by environmental OLs and OLOs in France

These figures of villains can be related to such obstacles as the actions of companies and state authorities' (in)action. By the actions of companies here, we understand greenwashing communication strategies or ineffective actions toward the energy transition. The state authorities' (in)action reflected mainly insufficient government actions in the regulation of energy policies.

The main heroes that should act for climate visualized in the analyzed posts are all people and activists in particular. The images illustrated people in climate marches or environmental campaigns as potential heroes for CC mitigation. We provide several extracts with pictures of heroes from analyzed images in Figure 122.



Figure 122 Heroes in the visuals to the posts by environmental OLs and OLOs in France

In most posts, fossil fuels and green energy were opposed in the visual mode. Fossil fuels were one of the main villains, and they were represented by fossil fuel stations and armed men protecting them. Renewable energies, such as windmills, represented “new” solutions to CC mitigation. We illustrate this opposition in Figure 123 and Figure 124. This communication technique of opposition between fossil fuels and renewable energies was widely used in the visuals by Greenpeace during their Fossil Free Revolution campaign. Nature and people, such as indigenous nations, mainly represented the victims in the visuals.



Figure 123 Image posted by @greenpeace_be, 12.11.2021



Figure 124 Image posted by @greenpeace_be, 17.12.2021

In the analyzed posts, biospheric and altruistic values were used to speak about the problems of CC mitigation and reasons for acting. Biospheric values were frequently illustrated with polluted sky from fossil fuel emissions, as shown in Figure 120. Altruistic value in the visuals referred to collective action organized by the NGOs, illustrated by people from climate

marches, protests, or campaigns (Figure 122). In these images, activists help the planet and other people, with particular emphasis on some posts on indigenous communities.

Regarding the **plastic signs**, the colors and forms within the images varied in terms of the type of enunciator. The predominant colors of the images included so-called natural colors such as dark blue, dark green, and brown. In a series of posts, cream beige was used as a background for the textual information, mainly posted by environmental OLs. We visualized the analyzed images in Figure 125, which are filtered according to their colors with the help of *ImageSorter*.

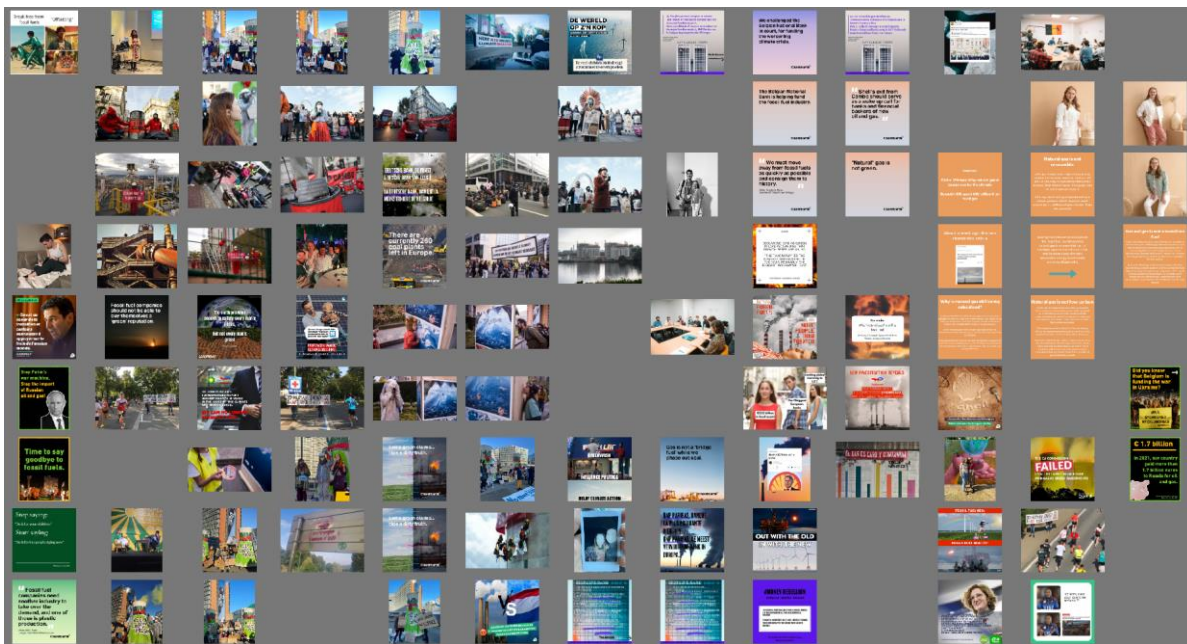


Figure 125 Visualization of 98 analyzed images from the corpus data, done with the ImageSorter V4

The clusters of dark blue, green, and brown colors appear on the left side of Figure 125. A minor part of the visuals used light colors – shown on the right side in Figure 125. Red and black colors in the images were generally associated with the obstacles to the energy transition. Green and blue colors associated with nature often reflected biospheric values. Figure 125 also illustrates the images containing verbal elements. In most cases, the verbal component of the image takes a central position, contrasting with the picture in the background.

Considering the **linguistic signs** of the posts, the images were frequently accompanied by the text within them. Indeed, 80 out of 98 images included verbal elements, and the analyzed videos used subtitles as the verbal component. Most of the dark-colored images included white

text: This allowed the readers to focus not only on the visual element but also on the verbal part within it. The text on-image elements generally took a central position within the image.

Some posts by environmental OLOs in Belgium are duplicated in two or three languages, such as the posts by Greenpeace on 24 January 2022. Figure 126 shows a screenshot of the post in English and French, and Figure 123 demonstrates a screenshot in English and Dutch. It should be noted that such communication techniques are widely adopted in organizational discourse compared to individual communication about sustainability transition in the energy field.



Figure 126 Post by Greenpeace in English and French, 24.01.2022

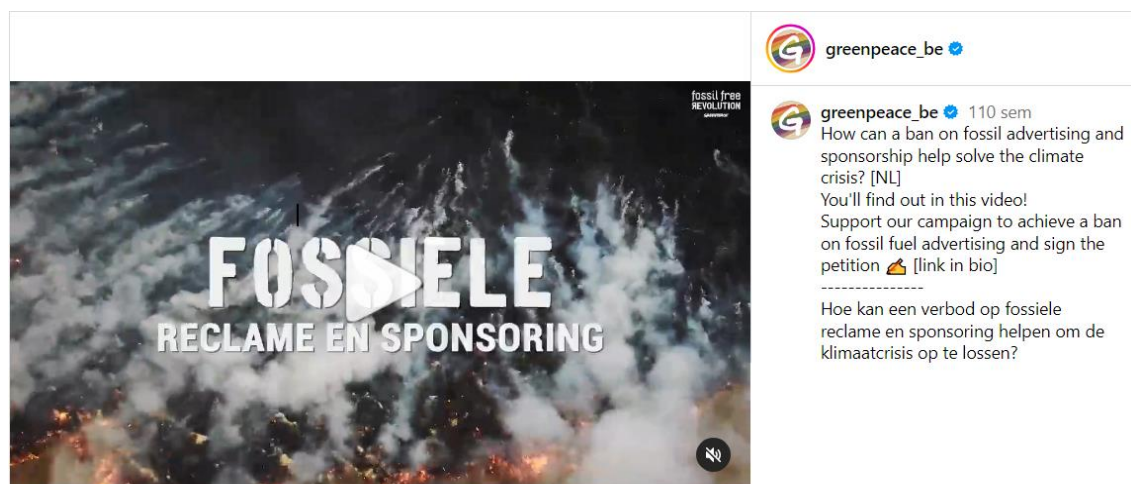


Figure 127 Greenpeace in English and Dutch, 24.01.2022

Generally, the analyzed posts included verbal descriptions or explications of the obstacles to CC mitigation in direct or implicit forms. The obstacles were mainly related to the (in)actions of politicians and fossil fuel companies, with particular emphasis on their misbehavior and unwillingness to follow sustainability transition. These obstacles were explicitly or implicitly introduced. For instance, direct obstacles were expressed in the video and the caption to the post by @cncd.11 on 01.04.2021. The organization wrote “*La mal gouvernance est un frein majeur à l’ambition*” in the caption. The video in this post showed an expert interviewed on the main TV channel, RTBF, about the barriers to pro-environmental action. In the video (which lasts 55 seconds), they directly discussed the obstacles to CC mitigation, which, according to Rebecca Thissen⁶⁸, are poor climate governance (“*mal gouvernance climatique*”) and the development of petrochemicals in Flanders (“*la pétrochimie qui freint*”). This obstacle can be linked to the egoistic value of authority that the government does not use to contribute to CC mitigation.

Another example of an obstacle can be demonstrated by a post’s caption by Greenpeace on 12 October 2021, where the organization implicitly evokes that advertising fossil fuels cannot help to mitigate the effects of climate change with the phrase “It’s not normal that fossil companies can advertise their activities that are killing people and the planet.” In this post, the organization focused on the actions of companies or fossil fuel industries as a major obstacle to change. Besides, the author highlighted the social power (egoistic value item) of fossil fuel companies that the companies do not use to influence the transition from fossil fuels to renewable energies.

A different post by @clientearth_ demonstrated implicit obstacles to CC mitigation. The organization wrote in the image: “Green claims, dirty truth” (Figure 128). With these metaphors, the organization blamed fossil fuel companies for the greenwashing that does not contribute to CC mitigation. The biospheric value in the text here is represented by the picture in a “before-after” style, whereas before is represented by a beautiful, clean nature and the “green claims” of the fossil fuel companies stated in the text. The after element is represented by the “dirty truth” in the text within the image, and the focus on greenwashing strategies by

⁶⁸ Responsible for the research on climate justice in CNCD-11.11.11

fossil fuel companies is discussed in the caption on the right in Figure 128. This linguistic sign is complemented by a visual representation of obstacles, i.e., a fossil fuel plant (iconic sign) supported by black and red-orange colors (plastic sign). The obstacle is in the verbal part of the image and the caption. As a result, the social influence of fossil fuel companies (egoistic value) transmitted through their green claims, which appeared to be greenwashing.

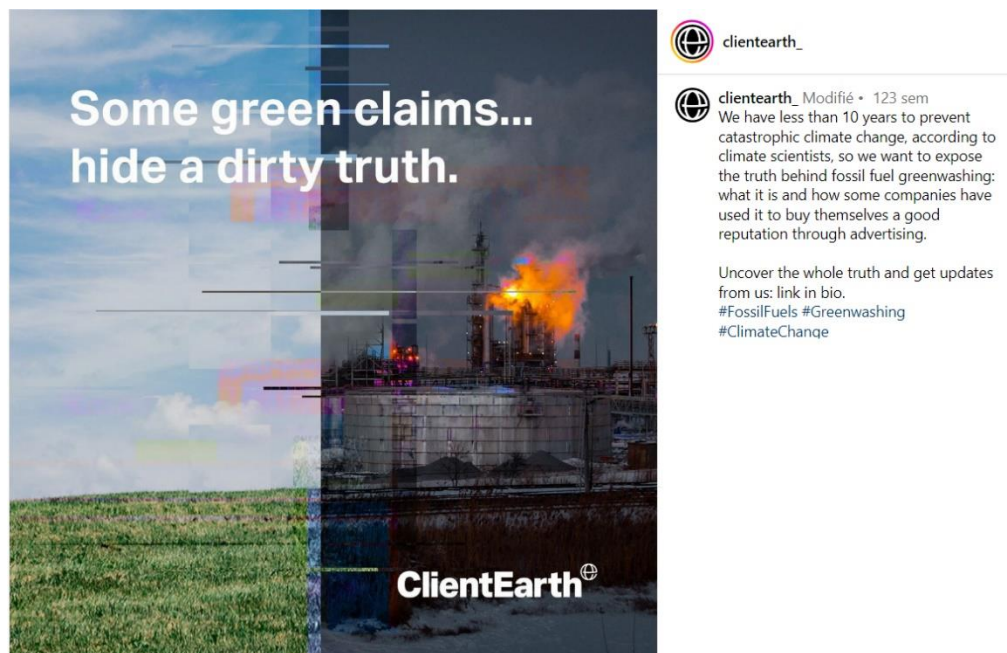


Figure 128 Post by clientearth_, 14.10.2021

In addition to the above-discussed obstacles, we observed two more indirect obstacles, or problems, that can interfere with sustainability transition – miscommunication or miscomprehension of climate science by media, governments, and citizens, which can influence a low level of citizen engagement in environmental issues. An example of this can be illustrated by the post by @thegreenmonkey on 11 March 2021 (Figure 129). The author criticized the media for transmitting information that was not fact-checked and provided people with controversial information, which may have contributed to the inaction. This obstacle can be linked to the egoistic value item of influence or social power attributed by the post’s author to the media. The OL critically reviewed a media article and provided qualitative information about the subject, citing relevant sources. Overall, the OL here performed the function of media with this post. The obstacle in this example was clearly stated in the verbal mode.

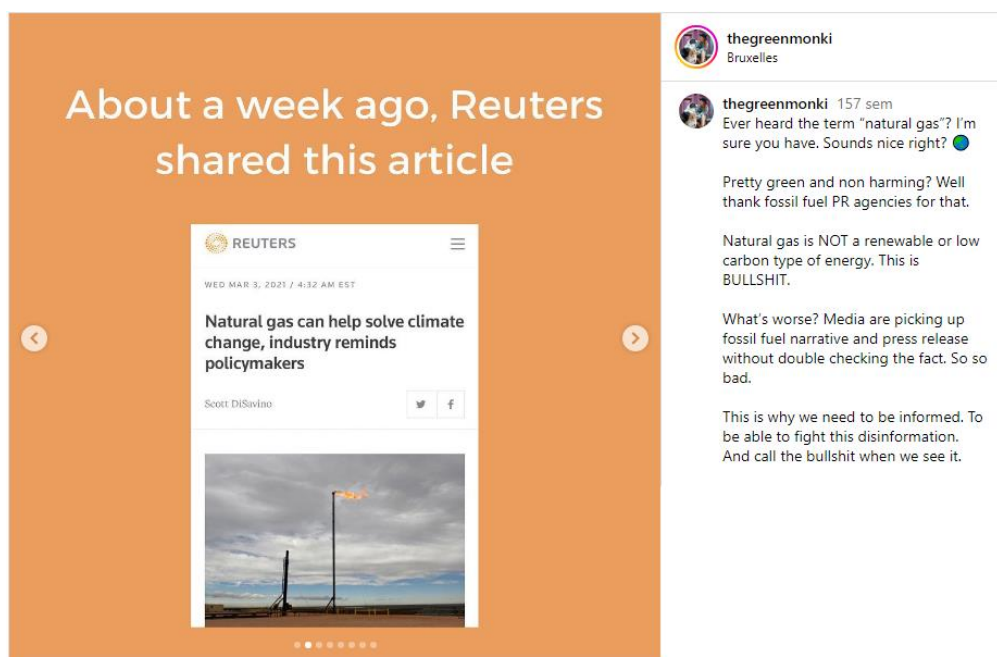


Figure 129 Post by @thegreenmonki on 11 March 2021

An interesting point that should be noted here is that the politicians from this case study rarely talked about the obstacles. They typically introduced the problem and suggested a solution to it. The obstacles to climate change mitigation were majorly introduced by climate activists, other influential individuals, or environmental OLOs, not politicians.

In the verbal mode, as in the visual one, the energy produced from fossil fuels was considered “dirty” and should not be produced. Renewable energies were always represented as solutions or “true green sources of energy” (post by @greenmonky from 14.01.2022). In one of the posts, the energy produced by windmills was represented as a victim of government policies and the functioning of nuclear energy plants. Most frequently, individuals were against calling gas a green solution to climate change mitigation, and they criticized politicians for their actions regarding the European taxonomy of fossil fuels. Politicians and the EU, in this case, played the role of villains.

Activists as heroes demanded radical changes in the energy sector, which the politicians, government, and the EU should do. Therefore, we may say that politicians and the EU were represented in some posts as heroes – they were the ones who should predominantly contribute to climate change mitigation policies, according to the posts’ authors. However, they did not take the right action and were criticized. The situation was different when the enunciator was a

politician who always outlined the problem or obstacle and possible solutions and emphasized their actions, particularly those directly linked to the sustainability transition.

In the analyzed posts concerning the energy sector, OLs and OLOs discussed fossil fuels more frequently than renewable energies. Nuclear energy was less observed in comparison to fossil fuels. In addition, the OLs and OLOs used the hashtag #fossilfree to underline the necessity of transitioning to green energy sources. To illustrate this, we processed the texts of the posts in *Sketch Engine* and performed a Word Sketch Difference function on the posts in English since they appeared more frequently in the data.

Figure 130 shows nouns more frequently modified by “renewable” and “fossil” as adjectives. The OLs and OLOs discuss renewable energy, capacity, and transition. When they used the adjective “fossil,” the OLs and OLOs discussed companies, gas, industry, advertising, infrastructure, greenwashing, advertisements, giant, lobby, project, sector, interest, era, firm, production, narrative, exploitation, agency, activity, and plant. The use of green and red colors in Figure 130 was not influenced by the positive or negative collocations and was attributed automatically by *Sketch Engine*. However, after having qualitatively observed all phrases, we may say that the phrases about the nouns modified by the adjective “fossil” were always used in the negative context within the posts.

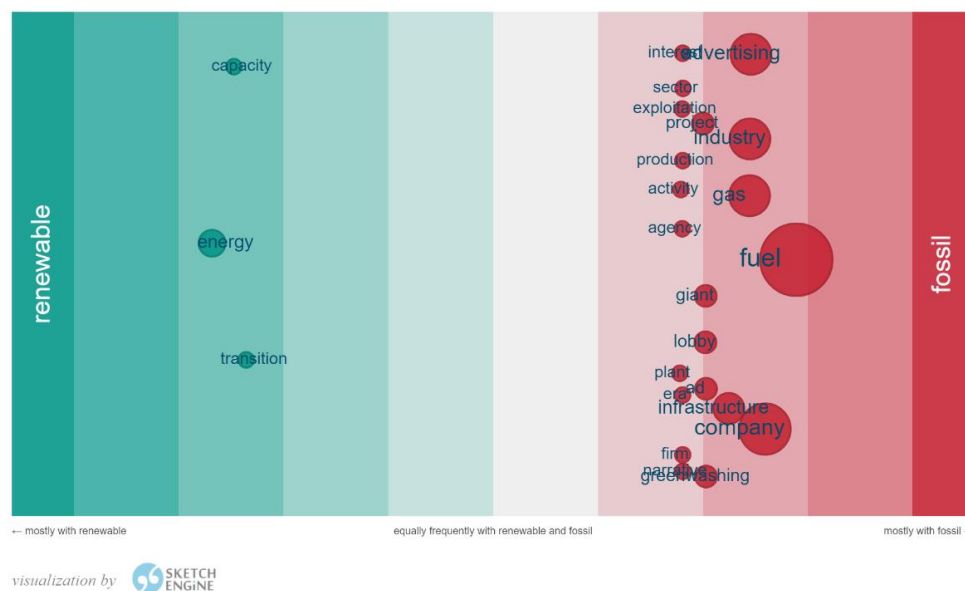


Figure 130 Word Sketch Difference of adjectives ‘renewable’ and ‘fossil,’ conducted in *Sketch Engine*

Many posts used metaphorical phrases in their captions. The most frequently used adjective in such phrases was “green,” which meant renewable or sustainable in such English examples as *green activities*, *green sources of energy*, *green energy*, *green claims*, *Green Deal*, *several green politicians*. In French, we observed two phrases including the same adjective “vert” – *Modèle vert de transition*, *investissements “non verts”*. This adjective is frequently opposed to the adjective “dirty” in such phrases as *dirty business*, *dirty energy*, or *dirty fuel*.

During the qualitative analysis procedure, we observed that in some cases, the obstacles were introduced in the texts including the “but” conjunction. We used the *Sketch Engine* Concordance function to better visualize all sentences including “but.” This conjunction was very frequently used in Instagram posts’ texts to discuss or explain certain information, as in the examples below:

- 1) [...] **But** let’s look at today’s actions. [...]
- 2) [...] **But** good news is [...]
- 3) [...] **But** what IS Taxonomy? [...]
- 4) [...] **But** gas has huge climate and economic risks [...].

However, in some cases, “but” was directly related to the obstacles to CC mitigation described in the captions. Figure 131 illustrates the use of “but” in the beginning and the middle of the sentence discussing the obstacles related to the government’s (in)action or actions of companies. For instance, line 3 states that “leaders agreed to phase down fossil fuels [...]. **But** [...] the EU is approving funding for new gas projects [...].” In this message, the European Union is accused of supporting fossil fuels, which does not contribute to the sustainability transition, according to the author.

Details	Left context	KWIC	Right context
1 ① isilFuels Stop Prohibited The COP26 is about to end and to finalise a climate action plan		but	the current draft is not ambitious enough. The science is clear; to keep global temperatur
2 ① using a lot of damage. We need to get off fossil fuels and transition to renewable energy.		But	Boris Johnson announced that he backs 16 new North Sea oil and gas projects going ah
3 ① COP26, leaders agreed to phase down fossil fuels and tackle methane for the first time.		But	in the meantime, the EU is quietly approving funding for new gas projects to the tune of €
4 ① rance. We've seen an increasing number of green claims for companies in recent years.		But	with that has come an increase in greenwashing - when a company tries to brand them
5 ① y is critical this decade. This means immediately reducing global reliance on fossil fuels.		But	EU institutions and national governments are still considering more gas pipelines and fo
6 ① carbon dioxide we release into the atmosphere, and burning coal is a major contributor.		But	governments in the EU hand out billions in subsidies to prop up coal every year. Tap our
7 ① whole truth. Fossil fuels are dropping in demand as renewables start to take their place		but	what are fossil fuel companies doing to protect profits? They're ramping up their investm
8 ① ead, it will "focus on the demand side." Shell's plan is to simply keep producing dirty fuel,		but	put the onus on consumers (something it's already doing). Oh, and it will put a little mone
9 ① rs (something it's already doing). Oh, and it will put a little money into renewable energy,		but	still just be a small fraction of the company's total investments. The most important thing
10 ① n the international targets. We are happy to see the big investment made in renewables,		but	it's not consistent as we are still pouring billions into the fossil fuel industry. What we are

Figure 131 Use in the context of the ‘but’ conjunction, made with the Concordance function in *Sketch Engine*

Another example used “*but*” in the middle of the phrase, line 9 of Figure 131, “[...] it will put a little money into renewable energy, **but still just be a small fraction of the company’s total investments** [...]”. In this example, the OL criticized the actions of Shell, which invested too little into renewable energy and simultaneously attributed the responsibility to its consumers. This criticizing opinion is also demonstrated in the text in the image attached to this post (Figure 132). Although the image illustrated the critics of Shell’s actions with the phrase “Shell’s CEO Thinks We’re Dumb” and the portrait of Ben van Beurden, the CEO of Shell, the image does not explicitly introduce the obstacles to CC mitigation or the values related to them, besides the emissions appearing on the background, which can be associated with the Shell’s activities.



Figure 132 Post by @thegreenmonki, 25.05.2021

Compared to the obstacles and values in general, the values concerning the obstacle were more frequently represented in the caption than in the image, less in the two modes, and only once in a visual mode, since it was discussed in the video. Egoistic values were more frequently represented in relation to the obstacles, including the misuse of their authority by the EU in the coordination of energy policies, particularly those related to taxonomy, and the desire by energy companies to gain profits from investing in fossil fuels.

To recapitulate, images served as illustrations of the captions in the multiple analyzed posts: They provided visual support to what had been discussed in the text. In other posts, Belgian environmental OLs and OLOs used informative images describing the problem and

proposing solutions. The obstacles in the visual and verbal modes generally reflected the actions of the government and fossil fuel industries that are not sufficient to achieve SDGs. These obstacles were frequently represented with black or red colors in plastic signs or metaphorical phrases in linguistic signs, such as “dirty truth.” The conjunction “*but*” was observed as a linguistic marker of obstacles in several posts. The obstacles in the observed visual and verbal modes were frequently related to egoistic and hedonic values. The role of biospheric and altruistic values was frequently attributed to the discussed solutions or reasons to act.

7.3.3 Sentiment analysis of the comments

Sentiment analysis of the comments was applied to complement content analysis results and categorize the positive, mostly positive, neutral, mostly negative, or negative elements within the comments. We presented the analysis procedure in Section 4.3.3.2 *Sentiment analysis of the comments*. In this part, we focus on the obtained results considering the comments to the posts by Belgian environmental OLs and OLOs about the energy transition.

The sentiment analysis results showed that the audiences preferred to use positive elements in their comments since most of the analyzed comments were identified as positive or mostly positive (65% in total). The results from the sentiment analysis are reflected in Table 43. One-fourth of the comments were identified as negative or mostly negative. It should be noted that more comments with negative elements were identified to the posts by organizations than by individuals. This could be related to a highly critical or even radical discourse shared by the environmental OLOs in our data.

Table 43 Sentiment analysis results concerning the energy sector in Belgium

Bert_Sentiment	Number of comments	% of total
negative	45	18,83%
mostly negative	15	6,28%
neutral	23	9,62%
mostly positive	10	4,18%
positive	143	59,83%
Total	239	100%

In addition to the sentiment analysis of the comments, we combined the results obtained from the content analysis (described in the next part) and the sentiment analysis results. This crossing of the variables demonstrated that the comments identified during the sentiment analysis as positive and mostly positive almost do not present obstacles in their texts. The obstacles to pro-environmental behavior appeared more frequently in the comments labeled as mostly negative (47%) or negative (42%) comments, as illustrated in Figure 133.

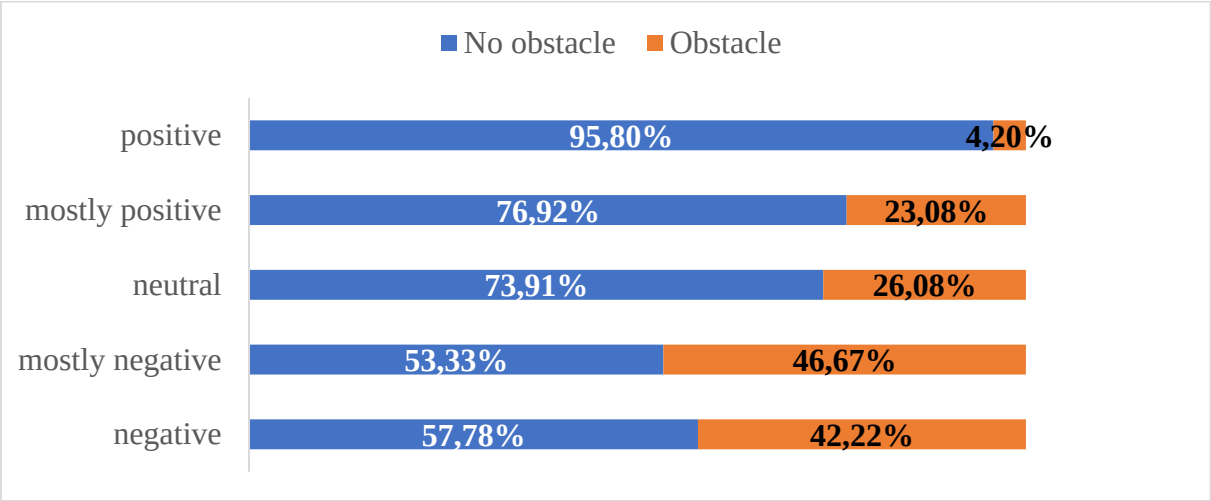


Figure 133 Sentiment-Obstacle relationship in the comments to the posts about energy transition in Belgium

These results partly confirm our **Hypothesis 3:**

The sentiment analysis of the comments will reveal messages, including obstacles to pro-environmental behavior or skeptical comments, which will be labeled as “negative” or “mostly negative.”

If the research project contains a more significant number of short texts, we suppose that sentiment analysis can be used to identify the obstacles. However, this method demands further fine-tuning and validation. The limitations of the sentiment analysis method are discussed in detail in part 8.2.2 *Limitations of data analyses*.

To summarize, the sentiment analysis of the comments to the posts by Belgian environmental OLs and OLOs regarding the energy sector revealed mainly positive responses from the audiences. However, examining these comments alongside manually identified obstacles demonstrated a complex relationship between the obstacles and the identified sentiments in the comments. Although the majority of the obstacles appeared in the comments

labeled as negative or mostly negative, the comments containing obstacles were also identified in neutral, positive, or mostly positive comments, yet with smaller proportions. This connection between the negative sentiments and obstacles should be further examined, and the sentiment analysis model demands further fine-tuning. In the next part, we focus on the obstacles, the values concerning the obstacles, and the narrative roles present in the analyzed comments.

7.3.4 Analyses of the comments

We applied content analysis to investigate the obstacles, values, and narrative roles in the comments. The detailed analysis procedure is explained in part 4.3.3.3 *Content analysis of the comments*. In this part, we focus on the comments considering the energy sector in the Belgian subcorpus.

Overall, 40 of 239 analyzed comments (17%) to the posts about the energy transition by environmental OLs and OLOs in Belgium included the obstacles to pro-environmental behavior. These obstacles were either directly or implicitly introduced in the comment's text. By directly communicating the obstacle, we understand clearly communicated obstacle to pro-environmental action by the enunciator. Implicitly expressed obstacles suggested but not directly expressed obstacles in the comments and demanded additional knowledge of the post's context. In some comments, we observed a combination of obstacles discussed by the author.

We divided the obstacles into five categories: *state authorities (in)action*, *organizing the action*, *communication and knowledge*, *actions of companies/organizations*, and *money*. Figure 134 demonstrates the numbers of each obstacle category calculated as a percent of the total number of occurrences of the obstacles (N=51). In the following paragraphs, we provide different examples of each obstacle category. Where possible, we note the observed environmental values to obstacle categories.

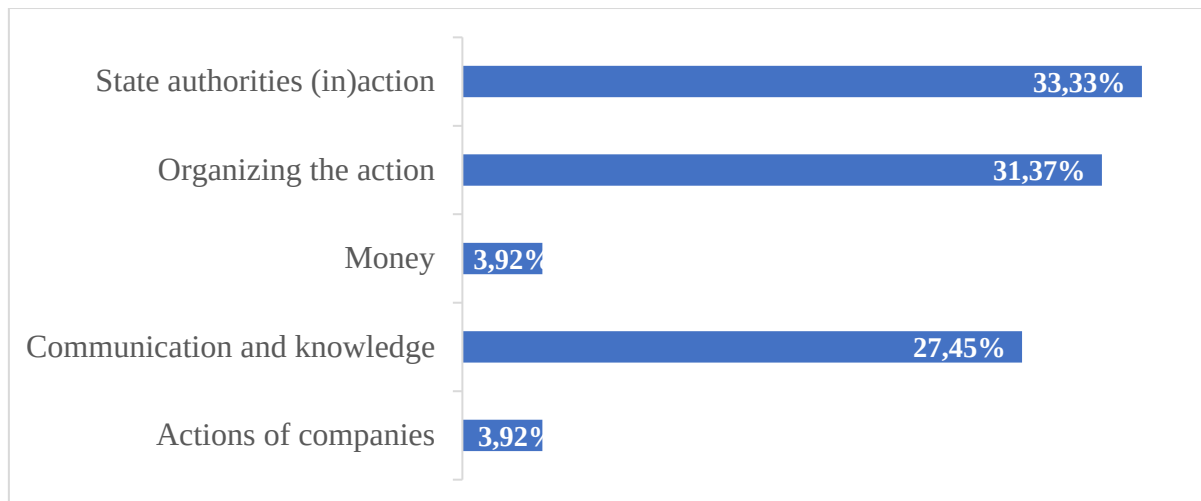


Figure 134 Categories of obstacles in the comments to the posts about energy transition in Belgium

The actions or inactions by state authorities were often represented as obstacles to the energy transition in the comments. They pointed to the wrong actions by the government that “blindly follow the arguments of big energy companies” (comment A) and “build even more gas-fired power stations, with taxpayers’ money” (comment B); in other words, it offered “grants for gas boilers” (comment D). In addition to this, the actions by energy companies building power stations were also identified as the obstacles in Comment B. Finally, people did not understand the actions of the government, as stated in multiple questions posted in Comment C. This obstacle category can be linked to the egoistic value of authority, which is not used by the government to contribute to the energy transition.

A: Thank you for the instructive post on the danger of labeling (natural) gas as a clean form of energy, Chloe! I like how you pinpoint that gas plants are not a "bridge" fuel to a more sustainable and environmental friendly energy sector like big energy companies tend to make us believe. Given that you live in Brussels, I was wondering what your opinion is on the Belgian energy strategy and its plan to use gas as a transition fuel to make the nuclear exit happen? The Belgian Federal Commission for Electricity and Gas Regulation (CREG) has shown that these new gas plants are unnecessary to ensure the security of energy supply in light of a soon-to-come nuclear exit, taking into account our current strategic reserve. **Still, the government seems to blindly follow the arguments of big energy companies, who desperately want to build new gas plants for their own profit** and will be running for at least 25 years, **instead of** investing in projects on energy efficiency, renewables, green innovation and other small-scale initiatives to decentralise the electricity market. By financing new gas plants, the Belgian electricity sector would become the second most polluting

electricity sector in Europe (after Poland) by 2030! In the context of global warming and the urgent need for climate action *now*, we cannot let this happen. Would love to hear your opinion on this!

B: The biggest stupid thing you can do for the climate is to build even more gas-fired power stations, with taxpayers' money (while extending nuclear power stations is at the expense of the operator, not the taxpayer), and with CO2 emissions that are 40 times higher than nuclear power stations.

C: Why aren't they (governments) turning the corner on fossil fuels and investing in solar, wind and hydro? What is it that they're failing to understand? **I don't get this hesitancy to go to the next best thing instead of hanging onto dirty energy source?**

D: And the government is **still** offering grants for gas boilers.

Although all analyzed posts considered mostly the transition in the energy sector, one comment evoked the obstacles related to government activities in the food sector. The author of comment E uses a form of order to the governments – using the modal verb “must” and 🇧🇪 emoji – to highlight the negative role of the Belgian government in communicating about different products, explicitly promoting dairy and meat industries.

E: Governments **must inform the people** about the products they buy and give the right signal **in stead of promoting dairy and meat industry on tv commercials**, like they do in Belgium 🇧🇪

The obstacles related to the organization of pro-environmental actions in the energy sector included building new infrastructures, which were further abandoned (comment F), suggesting that multiple solutions are needed besides renewable energies to tackle climate change (comment G), claiming the nuclear energy green source of energy (comment H), low potentials of wind (comment I) or solar (comment J and comment K) energies, and building new fossil fuel power plants instead of using existing infrastructures (comment I). Although these examples predominantly highlighted the importance of proper organization and better solutions to the sustainability transition in the energy sector, they were also linked to the actions of governments and companies.

F: And **it takes so much infrastructure to build then they just abandon it** when they're done.. like how is that not harmful to the planet 🤔

G: So just to be fair, yes gas is a fossil fuel, no debate, **but** it emits around 50 % less CO2 than coal and also less than oil. So it can be a temporary solution to reduce co2

emissions of heating process, electricity generation and transportation... **climate change will not be tackled with just one solution. We cannot just rely on wind farms, it is a complex approach where all efforts are welcome**

H: This green label for nuclear is also a fight against coal? Did I miss something in science? Do we currently have perfect ways to produce energy? ;) **Even if we would invest in the right places we would still need it because at the moment they either produce too little or too expensive or too pollutant each one of the best**

I: **You really think wind energy can replace fossil fuels?** Stop spreading illusions, the only thing we can do right now to reduce greenhouse gasses is with nuclear energy. No more blablabla, if we produce hydrogen with nuclear energy we could drastically reduce the greenhouse gasses within 10years. **Building natural gas powerplants to replace existing nuclear powerplants is just ridiculous.**

J: If new generation of environmentalists can't recognize that we need nuclear to sustain our energy needs, we are pretty doomed. On top of that, **let's not forget that solar panels need minerals extracted from mining activities to be produced and they create waste too at the end of their life cycle.**

K: If you know that solar panels on people's roofs cause problems with electricity, then you know why they abolished them. Plus the fact that solar panels are not recyclable and that they are more expensive and more polluting per kilowatt than nuclear energy. Nuclear energy is the only option for Belgium in the short term, if we want a long-term option we have to invest in nuclear fusion like France and Germany.

The obstacles related to communication and knowledge included not understanding the existing solutions (comment L) or why we need to follow them (comment O), emphasizing that there is no scientific consensus on renewable vs nuclear energy themes (comment M), not understanding why fossil fuels such as gas are not considered as green energy sources even though this was explained in the post (comment N), one comment criticized the post for insensitive communication about energy policies and the war in Ukraine (comment P).

L: **And what alternative to fossil fuels do you suggest?** I hear a lot of ignorant people say we have to quit fossil fuels, so my question is **what do we use instead?**

M: It is never about what one professor said, it is always about scientific consensus. **And the scientific consensus is not clear on this one.**

N: Let me ask this....the emission and oil used to build a windmill don't see a net positive for nearly two decades because of the fossil fuels needed to make it. **But** with current technology, gas production takes less emissions today than some "green" technologies. **So why is this a bad thing?**

O: that's not what I asked, **I reckonize we have to find a way to quit fossil fuels, I just want to know what the alternatives are?** Should we use nuclear, wind, sun? Everyone can say there's a problem, but the people who have the biggest voices don't offer any solutions. **Saying we have to invest in "renewable energy" without telling us what this magical renewable energy is, is gonna help anyone...**

P: As your Ukrainian follower, **I found the way you described the situation a bit insensitive.** I agree with environmental points you mentioned. I understand that economically you "don't need another war". But from the humanitarian point of view, is there a choice though? It is a one-sided aggression, a continuation of Russia's ongoing imperialistic agenda. I find in many of these discussions people omit putting themselves in the shoes of Ukrainians. Ukraine is not a mere arena for games between the West and Russia. Our sovereignty is at stake and we are asking for any help we can get. **I understand your post centers environmentalism, but constructive criticism never hurts.**

The obstacles, considering the *Money* and *Actions of companies*, were not numerous in the Belgian data and frequently combined with other obstacles. For instance, comment H emphasizes that some existing solutions are expensive, particularly solar energy panels (comment K). Comment A draws on the actions of companies "who desperately want to build new gas plants for their own profit." Another person wrote, "Thx for the enlightning. as long as there is money involved in any way, no initiative will be pure...everyone has an interest..." This comment demonstrates a doubtful position toward the actions of governments and companies regarding the financial resources involved in the energy transition. The examples of obstacles from this paragraph can be linked to the egoistic value item of wealth.

In addition to the obstacles, we attempted to identify the values behind them in the analyzed comments. In half of the analyzed comments, no clear value was observed. However, the other half was represented by egoistic values related to authority and wealth. The example comments about the obstacles considering *State authorities' (in)action* and *Organizing the action* highlight that politicians use the authority to help fossil fuel companies promote their activities. Fossil fuel companies, in turn, get financial benefits from the government and are not motivated to contribute to climate action.

We identified a significant number of villains in the comments. They included human personalities (politicians, activists, "us" or all people, "they" – unidentified group of people, people who have most significant voices), government structures (Belgium, government,

government), organizations, companies, and energy sources (solar panels, natural gas powerplants, fossil fuels, polluters, coal, polluting energy sources). In some comments, the authors used different forms of sarcasm to criticize the actions of politicians, comparing their speeches to childish behavior. For example, comment Q ridicules the speech of a politician from a green political party who claimed that Belgium could emit more CO₂ emissions since it is the country producing the lowest level of emissions in the neighboring area. The author finished the comment with the hashtag #balancetonecolo, commonly utilized to spotlight environmentally unsustainable behaviors within the ecology community.

Q: C'est l'hôpital qui se fiche de la charité! 😏 Votre super co-président a encore défendu les centrales au gaz cette semaine en disant que nous pouvions émettre plus de CO₂ car nos voisins en émettaient moins! **"Mon voisin a voisin a remplacé sa voiture par les transports en commun, cool je vais pouvoir m'acheter un Hummer..."** #balancetonecolo

Another comment represented a sarcastic view towards the taxonomy plan adopted by the EU: "Oh punaise le culot hahaha il est naturel tout comme le pétrole est naturel quoi 😏." With this phrase, the author stated his critical point of view about naming the energy from gas power stations as natural. Interestingly, sarcastic opinions appeared only in the comments in French languages, yet the majority of the comments were written in English.

The victims of the harmful actions of villains in the comments were the environment, all people or "us," and sustainable energies. The actors contributing to the solution to the climate crisis, in other words, heroes, are activists, "us" or all people, nuclear energy, everyone, fossil fuel companies, and the government.

After carefully observing the comments containing the obstacles to pro-environmental action, we made a list of words and phrases that can be used as markers of such discourse. These markers include such words as *still, just, but, even if ... still*. They are highlighted in red in the example comments in this part. To see the use of these phrases in context, we effectuated several *Sketch Engine* analyses of the comments in English (N=113) since they represent most of the data. The concordance function of the conjunction *but* allowed us to visualize the seven example phrases including this conjunction, while discussing the obstacle to pro-environmental action (Figure 135). These obstacles were related to the actions of governments (line 7), fossil fuels (lines 1, 2, 3, and 5), and communication issues (lines 4 and 6).

Details	Left context	KWIC	Right context
1 ① 't see a net positive for nearly two decades because of the fossil fuels needed to make it.		But	with current technology, gas production takes less emissions today than some "green" tec
2 ① vy fuel that releaseCO2 but also a lot of dust and toxic fumes. So yes, gas is not the best		but	it has a lower impact, and can be the solution today to phase out coal and oil. So just to t
3 ① .tion today to phase out coal and oil. So just to be fair, yes gas is a fossil fuel, no debate,		but	it emits around 50 % less CO2 than coal and also less than oil. So it can be a temporary
4 ① we are asking for any help we can get. I understand your post centers environmentalism,		but	constructive criticism never hurts. Wow. So many inaccurate views, opinions not verified I
5 ① ar is by far the best and most reliable source. Not only isn't it dependable on the weather		but	it will also last a longer time then for example a solar panel. The bottom line is the worst c
6 ① w didn't know How is coal still allowed in Europe? 🤔 Hey friends. I am with you on this.		But	I also want to know: what is a viable alternative? The gas lobbyists always talk about nati
7 ① alternatives are? Should we use nuclear, wind, sun? Everyone can say there's a problem,		but	the people who have the biggest voices don't offer any solutions. Saying we have to inve

Figure 135 Use in the context of the “but” conjunction, made with Concordance function in Sketch Engine, comments data in Belgium

Five example phrases in obstacle discussion were observed in the sentences, including the adverb *still*, which was employed to underscore the ongoing lack of contribution to environmental action by governments, with a focus on Europe. These examples are provided in Figure 136.

Details	Left context	KWIC	Right context
1 ① / in light of a soon-to-come nuclear exit, taking into account our current strategic reserve.		Still	, the government seems to blindly follow the arguments of big energy companies, who de
2 ① that not harmful to the planet 🤔 In China 62 % of electricity is produced by coal. Coal is		still	the main energy used for heating residential buildings in Poland. Most of cargo vessels a
3 ① perfect ways to produce energy? :) Even if we would invest in the right places we would		still	need it because at the moment they either produce too little or too expensive or too pollu
4 ① o the next best thing instead of hanging onto dirty energy source? And the government is		still	offering grants for gas boilers. 🗨️ meanwhile we have 🗨️ This will not go in your favor. L
5 ① .rel. Fracking poisons future drinking water 🤔 It's the worst! Wow didn't know How is coal		still	allowed in Europe? 🤔 Hey friends. I am with you on this. But I also want to know: what i

Figure 136 Use in the context of “still” made with Concordance function in Sketch Engine, comments data in Belgium

The adverb *just* in the comments was used in two meanings: 1) to add emphasis to a statement meaning simply or absolutely (lines 2, 3, and 7 in Figure 137) or 2) meaning “only” (lines 1, 5, 6, 8, and 9 of Figure 137). Not all lines in Figure 137 represent obstacle-related phrases; however, some highlight the necessity of clarifying certain information about renewable or fossil fuel energies. This is the case of phrases in lines 1 and 9 of Figure 137.

Details	Left context	KWIC	Right context
1 ① tions :D Merci pour ce récap! Trop intéressant comme d'hab 🤔 Yes, definitely! 🗨️ I		just	wonder what do you think about biogas from wastewater treatment, with content similar to
2 ① ild love to hear your opinion on this! And it takes so much infrastructure to build then they		just	abandon it when they're done.. like how is that not harmful to the planet 🤔 In China 62 %
3 ① xest but it has a lower impact, and can be the solution today to phase out coal and oil. So		just	to be fair, yes gas is a fossil fuel, no debate, but it emits around 50 % less CO2 than coal
4 ① rocess, electricity generation and transportation... climate change will not be tackled with		just	one solution. We cannot just rely on wind farms, it is a complex approach where all effort
5 ① and transportation... climate change will not be tackled with just one solution. We cannot		just	rely on wind farms, it is a complex approach where all efforts are welcome Frequently Asl
6 ① , that I am, I respect the position of the Minister of Energy. Democratic national politicians		just	want to govern; for to be able to do so, they need be re-elected in a not so distant future.
7 ① ithin 10years. Building natural gas powerplants to replace existing nuclear powerplants is		just	ridiculous. Alexandre est trop occupé à QR coder sa population And what alternative to fc
8 ① ero-carbon emissions solutions that exists! Time for collaboration! Time for everyone, not		just	the fossil fuel companies to step up! Let's go!!!! 🗨️ they should be taxed Woah 🗨️!
9 ① nels, etc. that's not what I asked, I reckonize we have to find a way to quit fossil fuels, I		just	want to know what the alternatives are? Should we use nuclear, wind, sun? Everyone cai

Figure 137 Use in the context of ‘just’ made with Concordance function in Sketch Engine, comments data in Belgium

In addition to observing the words in context, we applied a Word Sketch Difference function to evaluate the use of adjectives *renewable* and *fossil* in the English comments to the posts by environmental OLs and OLOs in Belgium. As a result, the word *renewable* was used in seven comments in the phrase *renewable energy* only. The adjective *fossil* was used 13 times with nouns such as *fuel*, *gas*, and *company* (Figure 138).

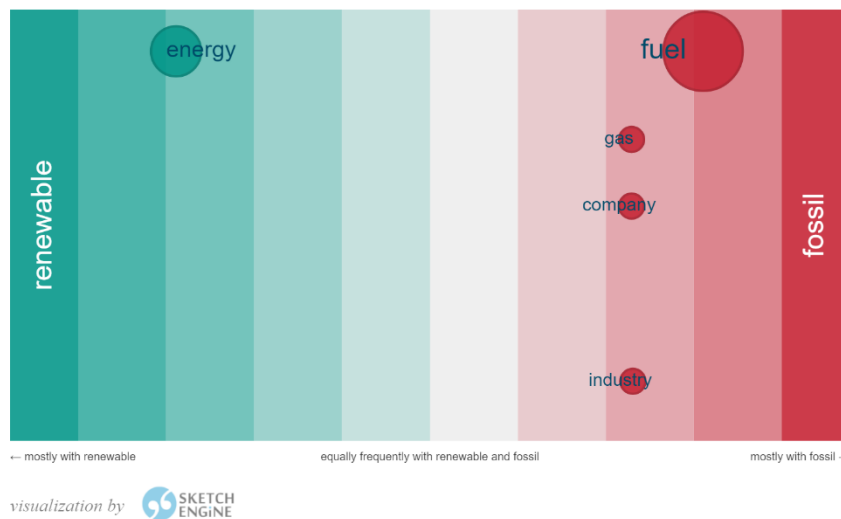


Figure 138 Word Sketch Difference of adjectives “renewable” and “fossil,” conducted in Sketch Engine to the comments in Belgium

Although the adjective *renewable* was frequently used with a positive connotation in the posts’ texts (cf. Section 7.2.2 *Multimodal discourse analysis of the posts*), it was frequently used with a negative connotation in the comments, as we already saw in comment O above. Besides this, renewable energy sources, such as solar or wind energy, represent a particular problem in comments J, K, and N.

7.3.5 Discussion and summary of the results

In this part, we synthesize and reflect on the results from a mixed-method case study of Instagram posts and comments to them concerning renewable and fossil fuel-produced energies discussed by Belgian environmental OLs and OLOs in January 2021–March 2022. We qualitatively observed 67 posts by environmental OLs and OLOs in Belgium and combined this observation with computer-assisted linguistic analysis to identify specific patterns or markers. Then, we analyzed 239 comments to the selected posts by applying a three-method approach: sentiment analysis, content analysis, and computer-assisted linguistic analysis. The analysis of

the posts provided us with different trends in multimodal communication about the energy transition in Belgium between January 2021 and March 2022. The analysis of the comments provided the audience's reflections on the problem. Overall, this mixed-method research design allowed us to identify specific trends in communication, the obstacles to CC mitigation in the energy sector, the related values, and narrative roles.

Regarding the iconic signs of the posts, the most frequent visual element in the analyzed posts was the emissions from fossil fuels in the atmosphere. They were often accompanied by the adjective *dirty* in such metaphorical phrases as “dirty claims” or “dirty truth” in linguistic signs. This element was used as a significant trending pattern by different environmental OLOs to discuss the actions of fossil fuel companies as obstacles. Besides, the OLs and OLOs linked these images of the fossil fuel industry to the necessity to care for nature – biospheric value.

Many images of people were observed in this case study, illustrating people in climate marches or environmental campaigns as potential heroes to CC mitigation. These human figures in the images were directly related to the altruistic value item of helping others and social justice. In addition to this, altruistic values were sometimes intertwined with biospheric values, such as preventing pollution, which is needed not only for nature's recovery but also for people's health and well-being.

The clichés or iconic images of glaciers and polar bears appeared in several images in this case study, representing glaciers and polar bears as victims of CC and human activities. Many scholars claimed that media and NGOs overused these icons (Doyle, 2007; O'Neill, 2022; San Cornelio et al., 2024). We argue that Belgian audiences can consider these images distant, reinforcing the feeling that CC is a distant problem. In addition, these emotionally negative images can produce a “freezing” effect on the viewers, i.e., slowing the audience's reaction time (Carlson et al., 2020). Therefore, we recommend that the environmental OLs and OLOs shift from this representation of CC consequences and adopt concrete and contextualized communication about the energy transition and CC mitigation. For example, positive discourses about energy transition using images of windmills or solar panels can attract the audience's attention and possibly motivate environmentally friendly efforts (Carlson et al., 2020).

Regarding the plastic signs, most of the images by organizations in this case study included dark colors and dramatic scenery, particularly when discussing the obstacles to CC mitigation, which may evoke a feeling of fear in their audiences. These fear-induced

representations also appeared in mass media. However, they can be less effective than a positive framing of CC-related issues (O'Neill & Nicholson-Cole, 2009).

Overall, we identified three types of images that can characterize Instagram discourse about the energy transition in this case study. These visuals include knowledge or informative images, purposeful illustrations, and spectacular memetic images.

Informative or knowledge images can be described as still images containing informative text in a central position. The text aims to communicate about a specific subject or fact or to explain certain positions. In this case study, such visuals used predominantly single-colored backgrounds. These knowledge images were sometimes used as illustrations of what was written in the post's caption (Catellani, 2018). This was used mainly to highlight the discussed information or to provide specific examples. We visualized several examples of such visuals in Figure 139.



Figure 139 Information or knowledge images in the posts about energy transition in Belgium

Another type of images was represented by photographs from protesting actions. Youth for Climate, Extinction Rebellion, and Greenpeace mainly used these visuals to report on the protests, marches, or specific campaigns. Although these images typically illustrated the actions discussed in the posts' captions by providing proof with these visuals, the movements and NGOs aimed at mobilizing larger audiences and engaging them in action. Activists were generally represented as heroes in these images. These characteristics combine several image categories proposed by Catellani (2018): illustrations and ethical images, where an image serves as an illustration to the caption by portraying potential or actual heroes. Besides, these images can be directly related to the purposeful images category, i.e., "narrative that attempts to encourage individuals to act and contribute to the solution" proposed by San Cornelio et al. (2024, p. 8). In this case study, we name these images purposeful illustrations since their main

aim was to support the posts' captions, which tried to engage the audiences in climate action. Figure 140 reflects several examples of purposeful illustrations. Youth for Climate's purposeful illustrations of climate action were positively framed by smiling people participating in protesting the action. On the contrary, the images by Greenpeace or the XR were dramatic, simultaneously framing activists as heroes and victims.



Figure 140 Purposeful illustrations in the posts about energy transition in Belgium

The last category of observed visuals in this case study includes memes or spectacular images (Catellani, 2018). A present memetic structure or pop culture elements can characterize these images. The fourth example from Figure 141 uses the references to the film *Don't look up*. According to Doyle (2022), this film did not provide any direct reference to CC; however, it is frequently used as a climate communication film, which provides a satirical view on political and societal responses to CC. Following research by San Cornelio et al. (2024), we suggest that such memes can help draw attention to environmental issues and climate organizations.



Figure 141 Spectacular images in the posts about the energy transition in Belgium

In the linguistic signs, the identified metaphorical phrases in our corpus are not new for environmental studies. Some metaphorical phrases in French identified in the posts, such as *modèle vert de transition*, *investissements "non verts,"* or in English, *dirty business* can be related to the market or economics metaphors in CC communication in political discourse as

suggested by Nerlich (2011). Other studies focusing on political discourses compared the use of green/dirty or clean/dirty metaphors framing CC and solutions to it in a speech by President Obama (Negrea-Busuioc, 2017).

The major obstacles to the energy transition in the posts were related to the actions of fossil fuel companies, such as controversial communication strategies, greenwashing, or unwillingness to shift to renewable energies. This obstacle was frequently related to the egoistic values of social power or wealth. Indeed, the companies possess a certain level of power within the society but do not use it to contribute to CC mitigation. Besides, according to the environmental OLs and OLOs, these companies purposefully do not contribute to the transition because they profit more from fossil fuels than renewable energies.

Another obstacle in the posts was related to the actions of the government, the EU, and other state authorities, who do not use their authority (egoistic value) to adapt sustainability policies. The obstacles regarding the actions of state authorities and fossil fuel companies in the analyzed posts can be linked to political and economic order frames present in communication about energy futures by Fridays for Future and Extinction Rebellion in Germany (Buzogány & Scherhauser, 2022). In addition, the OLs and OLOs emphasized the role of media for the sustainability transition, specifically their miscommunication or miscomprehension of CC, which can also influence a low level of citizen engagement in environmental issues.

As demonstrated by the visual typologies above, the text in the visuals took a significant position: It was more frequently highlighted in the foreground. Although the obstacles to CC mitigation in the energy sphere were sometimes emphasized in the visual mode, the verbal mode was crucial in describing the obstacles in the posts. This confirms our **Hypothesis 2**:

The obstacles will be more clearly stated in the verbal mode of the posts, i.e., captions or text-on-image elements, on Instagram.

In the observed posts, we saw a tendency to highlight the transition from fossil fuels in general instead of discussing concrete solutions, such as installing solar panels or changing the energy provider to renewable energies. Organizations more frequently emphasized that fossil fuel companies were villains, and governments and the EU were the main actors responsible for CC mitigation. In the posts by the individuals, government and fossil fuel companies are also attributed responsibility and blame. The environmental OLs represented by politicians in our data underlined the outcomes of their work towards sustainability. All types of enunciators generally mentioned everybody as heroes in the sustainability transition, underlying the

importance of collective action. Figure 142 summarizes the narrative roles – villains, victims, and heroes – attributed to different actors in the posts and comments.

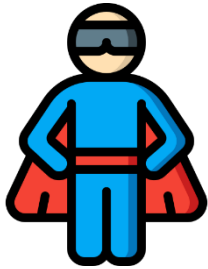
			
Posts	We, all people, Environmental NGOs, activists, the EU, Belgium, politicians, Zuhair Demir (Member of the Flemish Parliament)	People, indigenous people, planet, nature, Flemish people	Fossil fuel companies and their CEOs (Chevron, EDP, ENI, Exxon Mobil, Shell, TotalEnergies), the EU, the European Commission, the European Parliament, Belgian government, politicians (Boris Johnson), banks (BNP Paribas, Deutsche Bank, Belgian National Bank)
Comments containing obstacles	Activists, we, nuclear energy, everyone, fossil fuel companies, government	Environment, people, sustainable energy, we/us	Belgium, politicians (Mme VdStraeten), activists, solar panels, us, natural gas powerplants, they, government, fossil fuels, polluters, coal, organizations, polluting energy, solar panels, people who have biggest voices

Figure 142 Narrative roles in the posts by environmental OLs and OLOs in Belgium

The barriers to the sustainability transition in the energy sector discussed in the comments correlated with those discussed in the posts. The obstacles in the comments reflected a lack of contribution to pro-environmental efforts from government authorities or political leaders, as well as actions by companies, specifically fossil fuel corporations. Another barrier that appeared in the comments was associated with the organization of the action, which was caused by the problems with the energy infrastructures and the low potential of renewable energies. Indeed, in the posts, renewable energies were described as heroes that could help energy transition. In the comments, these energies were frequently criticized, particularly for low efficiency, certain

levels of pollution, and the high prices of these types of energy. These barriers are linked to global environmental actions, which should be addressed to achieve SDGs.

As discussed in Section 1.1.2 *Climate change mitigation: Belgian context*, there is a rise of pro-nuclear views in Belgium, which can be considered a significant challenge for the energy transition (Taylor, 2023). In our data, nuclear energy was discussed in only two comments, which suggested nuclear energy as a short-term solution or asked whether the use of nuclear energy was in line with CC mitigation.

In a large part of the analyzed comments, we observed the barriers related to the communication about the solution to CC mitigation. The media attention attributed to renewable and fossil fuel energies was a complex issue communicated differently by different media channels. These differences in communication often confused people as they addressed their questions regarding these energy sources to the environmental OLs and OLOs. In this case, the environmental OLs and OLOs were considered experts: People sincerely asked them questions about the energy transition, highlighting their confidence in the responses provided by the OLs and OLOs. The questions included asking for the recommendation of green energy sources for personal use, clarifications about renewable energy sources, particularly wind and solar energy, and clarifications about nuclear energy.

In a few comments, we observed the important role of money, which may influence climate inaction. On the one hand, this is because of insufficient financial resources for individuals to install solar panels. On the other hand, banks' financing of fossil fuels was considered another obstacle concerning money. This obstacle category can be directly linked to the egoistic value item of wealth. Nisbet and Kotcher (2009) noted that an economic consequences frame can be used to both oppose and promote climate policy, depending on the actors in question. Following this idea, we suppose that such negative framing of expensive solutions can demotivate climate action in the energy sector. In this case, we suggest that communicating about provided subsidies for solar panel installation or house insulation can positively impact or motivate people to act.

As mentioned in the previous paragraphs, the obstacles to pro-environmental action in the energy sector were mainly related to the egoistic values in the analyzed posts and comments to them. This confirms our **Hypothesis 1**:

The obstacles to pro-environmental behavior in both posts and comments to them will be predominantly referred to the egoistic or hedonic values.

The most frequently used markers in the identification of the obstacles were observed in the verbal mode. In both posts and the comments, the conjunction *but* was frequently used to introduce a barrier to pro-environmental action. In linguistics studies about CC discourses, this *but* (yet, in the French language) was identified as a concession marker introducing different forms of criticism (Fløttum et al., 2019; Fløttum, Gjerstad, & Oloko, 2021). In addition, the adverbs *still* and *just* were often used in the comments while discussing the barriers.

Most of the barriers expressed in the comments were attributed to negative, mostly negative, or neutral sentiments during the sentiment analysis. In a few cases, the obstacles were identified in the comments, which were labeled positive or mostly positive. This result partially confirms our Hypothesis 3.

Hypothesis 3:

The sentiment analysis of the comments will reveal messages, including obstacles to pro-environmental behavior or skeptical comments, which will be labeled as “negative” or “mostly negative.”

In this case, we suggest that the sentiment analysis method can be used to identify the obstacles to CC mitigation in short texts, yet it demands prior fine-tuning on climate-related data.

To recapitulate, the analyzed posts considering the energy transition by environmental OLs and OLOs in France generally followed a pattern of presenting a problem, highlighting villains, proposing solutions, and inviting discussion. We identified three trending types of visuals in this discourse: information or knowledge images, purposeful illustrations, and spectacular images (Catellani, 2018; San Cornelio et al., 2024). The iconic, plastic, and linguistic signs intertwined with the representation of obstacles, values related to them, and the narrative roles. In their posts, the environmental OLs and OLOs in Belgium mentioned insufficient actions from companies and state authorities as significant obstacles to CC mitigation. In the comment data, the most frequently discussed obstacles were linked to the actions of the government, the organization of the action, and problems in communication. In most posts and comments, the obstacles to pro-environmental efforts were linked to egoistic value items of social power, authority, or wealth.

The sentiment analysis revealed obstacles in the negatively labeled comments, which can represent a potential for future studies based on a large number of short texts to identify the obstacles to pro-environmental action. However, the accuracy of this method needs to be improved for future research. The posts and comments were both problem and solution-

oriented. The environmental OLs and OLOs generally identified the problem and proposed solutions. Nevertheless, the solutions in some cases were too large. Both the posts and the comments highlighted the role of media and communication about the energy transition. Although influencer marketing is not a frequent tool to promote green energy (Zatwarnicka-Madura et al., 2022), we suggest that communication about the energy transition is essential and communicators, i.e., environmental OLs and OLOs, should adopt more concrete forms of informing citizens about the existing solutions in the energy sector. More practical recommendations concerning communication about the energy transition are discussed in Section 8.3.1 *Implications for communication practitioners*.

7.4 Case study 4: Communicating about sustainability transition in the energy sector in France

The present case study discusses the communication about the sustainability transition in the energy sector by environmental OLs and OLOs in France. We apply a mixed-method research design to address multimodal data from Instagram. First, we introduce the selected data, i.e., posts, visuals, and comments. Second, we provide the results from multimodal discourse analysis of the posts, which are complemented by computer-assisted linguistic analysis to provide more straightforward examples of specific phenomena. Third, we demonstrate the results from the sentiment analysis of the comments. Fourth, we present the results from the content analysis of the comments. Finally, we summarize and reflect on the results of this case study.

7.4.1 Selected data

To investigate the communication about the sustainability transition in the energy sphere in France, we selected the posts by OLs and OLOs from the *Corpus21-22_FET* obtained from an automated content analysis (cf. Section 4.3.1 *Automated content analysis*) and multimodal content analysis (cf. Section 6.2 *France*). These posts discussed fossil fuels and renewable energies since the obstacles were mainly discussed in these posts regarding the energy sector in France. In this part, we detail selected data.

In total, we selected 61 posts, which included 172 media files consisting of 172 images and 4 videos posted by environmental OLs and OLOs in France. The difference in the mean numbers of images and videos is not significant in this subcorpus. Organizations and individuals

posted, on average, three images per post. Contrary to other case studies, the organizations tended to post more media files in one post, with the mean number of images per post equal to 2,875 compared to 2,71 images by the individuals. We illustrate these statistics in Table 44.

Table 44 Corpus of posts regarding the energy transition by environmental OLs and OLOs in France

Enunciator	Posts analyzed	Number of images	Number of videos	Mean number of images per post	Mean number of videos per post
OL_FR	21	57	1	2,71	0,05
OLO_FR	40	115	3	2,875	0,075
Total	61	172 (97,72%)	4 (2,28%)	2,82	0,065

Overall, individuals and organizations posted images as media content: images were present in 98% of the posts by both individuals and organizations. Typically, the posts by individuals and organizations either included images or videos.

During the data collection stage, we also obtained 1185 comments to the selected posts by French OLOs and OLs. Before analyzing the comments, we cleaned the data by deleting mentions and links to other resources that do not possess any emotional function. We also deleted the duplicate comments posted by the same person to the same post. Overall, we obtained 1099 clean comments ready for the sentiment analysis (Table 45). However, after having effectuated content analysis, we discovered that only 17,65% of the comments contained obstacles within them (Table 45). The detailed content analysis results are further discussed in part 7.4.4 *Analyses of the comments*.

Table 45 Comments data to the posts about energy transition by French OLs and OLOs

Type of account	Comments collected	Comments cleaned	Comments with obstacles
OL	660	617	116 (18,80% from cleaned)
OLO	525	482	78 (16,18% from cleaned)
Total	1185	1099	194 (17,65% from cleaned)

The detailed analysis procedures are provided in Section 4.3.3 *Case studies' analyses: a mixed-method approach*. In the following parts, we discuss the results of the case study investigation.

7.4.2 Multimodal discourse analysis of the posts

We conducted a multimodal discourse analysis of 61 selected posts by environmental OLs and OLOs to understand the representation of obstacles, values, and narrative roles regarding the transition from fossil fuels to renewable energies in France. We discussed and detailed the analysis grid in Section 4.3.3.1 *Multimodal discourse analysis of selected posts*. In the following paragraphs, we elaborate on the analysis results following the analysis grid: first, we discuss iconic signs; second, we introduce plastic signs; third, we highlight the linguistic signs.

In the analyzed posts, we observed three main themes: attribution of responsibility and blame, civil protesting actions, and personal experiences. The posts about the attribution of responsibility and blame discussed mainly the responsible actors for CC mitigation and those who do not sufficiently contribute to it. Civil protesting actions represented photos and texts illustrating climate marches or specific campaigns against fossil fuel energies. Posts about personal experiences covered mainly experiences with different energy suppliers and discussions of their benefits or disadvantages. All three themes included a common component – solutions. In other words, the environmental OLs and OLOs proposed possible solutions to CC mitigation in their posts. However, these solutions were not always concrete.

Considering the **iconic signs**, i.e., what is represented in the post and what it signifies, the images illustrated mainly people, different energy sources, and nature. Indeed, images of humans appeared in 61 out of 176 visuals (35%). These images showed people of different ages and sexes as active participants in protesting actions contributing to climate action. In this case, these individuals can be seen as heroes. In several cases, such images of people were linked to the altruistic value of helping others, specifically when a text emphasized it. We visualized several images of people in Figure 143.



Figure 143 Humans as heroes for the energy transition in the posts by environmental OLs and OLOs in France

Although in most images, people were illustrated as heroes, in several pictures of politicians, they were shown as villains because their actions contradicted the SDGs and CC mitigation policies. This insufficient action from political leaders can be linked to the obstacles category *State authorities' (in)action*. In the images, this obstacle was represented by political figures giving speeches at COP meetings, which can be linked to the egoistic value of authority. The most frequently criticized political leader was President Macron, who appeared in 7 images in this case study. The image of President Macron was frequently caricatured. Figure 144 demonstrates such representations of the political leader.



Figure 144 President Macron in the posts about the energy transition by environmental OLs and OLOs in France

Nature was underrepresented in the analyzed visuals. We observed several pictures of the sea, sea creatures, birds, sky, glaciers, elephants, and seals. These visuals can directly relate to the biospheric value item of protecting nature.

The iconic signs concerning the energy sector were represented by fossil fuel pipes, constructions, emissions from fossil fuels, and renewable energies, such as solar panels or windmills. Renewable energies in the majority of the visuals were represented as heroes, i.e., the energies that contribute to a sustainable future. Nevertheless, in one post, the windmills were shown as villains due to their adverse effects on biodiversity, although these negative impacts were discussed in the text within the image, not in particular representation of windmills. Fossil fuel energies and emissions from them were frequently represented as villains in the posts, polluting nature and the environment (biospheric value). We illustrate these elements in Figure 145 under numbers 1, 2, and 5.



Figure 145 Obstacles in visuals considering the energy sector posted by environmental OLs and OLOs in France

Images of money in this case study were frequently related to the egoistic value item of wealth. In their visuals, the OLs and OLOs used icons of different currencies, such as \$ or €, as well as images of money, as demonstrated in Figure 146. Figure 146 shows a person's hands holding a five-euro banknote and several coins. The post described the banks' financing of fossil fuel industries as an obstacle since it can harm the planet. According to the post's author, the banks generally do so to get profits from these industries (egoistic value item of wealth). Therefore, several individuals suggested changing to more sustainable banks. However, the post's main idea can only be understood after reading the caption (linguistic sign).



Figure 146 post by @lespetitsgestes, 22.02.2022

Concerning the **plastic signs**, the visuals reflected dark colors like black or brown (left top corner in Figure 147), where black appeared more frequently in the images concerning obstacles and brown was in the photos of protesting actions. The clusters of blue and green colors generally associated with nature are largely present in the corpus (top right corner, bottom right corner, and left part of Figure 147). These colors were often linked to the biospheric values. Grey and light colors represent a separate cluster in this case study. We illustrate all analyzed images sorted by color with *ImageSorter* in Figure 147.

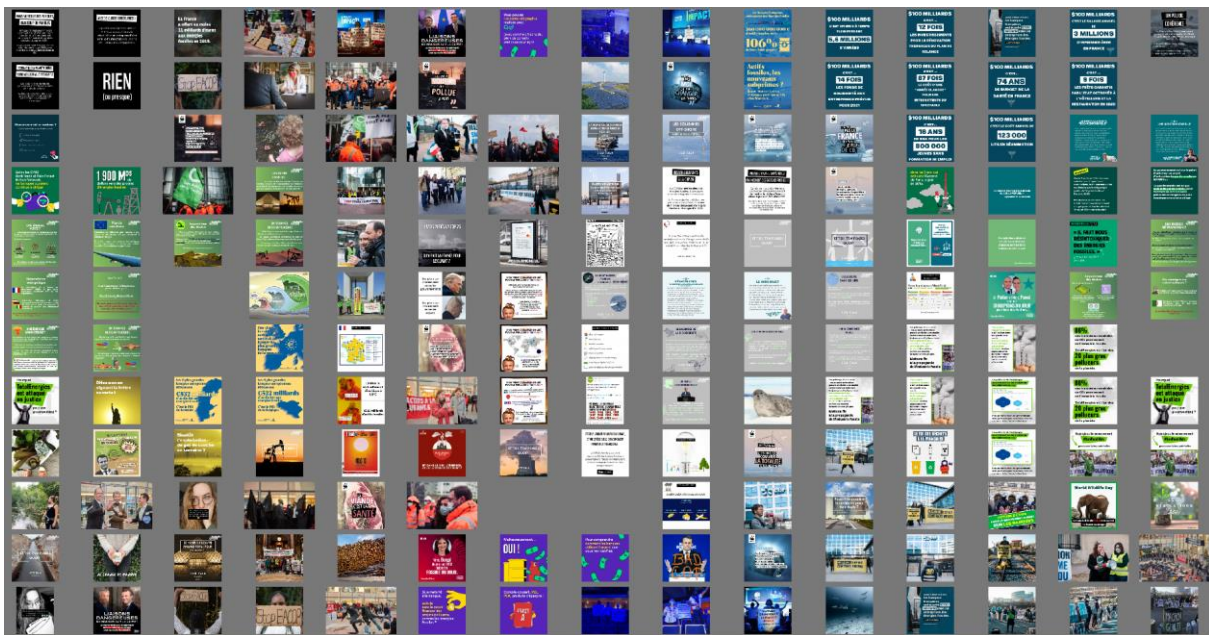


Figure 147 Visualization of 172 analyzed images from the corpus data, done with the *ImageSorter V4*

In plastic signs, black, red, and sometimes orange colors were directly associated with the obstacles. These colors are used to confront certain politicians or fossil fuel companies for their insufficient actions. Images 1, 4, and 6 from Figure 145 illustrate the use of red and orange colors in relation to the obstacles. Image 3 from Figure 145 shows the use of black color as a symbol of inaction. However, to strengthen the representation of the obstacle, the word **RIEN** in white capital letters is used to emphasize insufficient actions from the government. This image demonstrates an essential relationship between plastic and linguistic signs within the posted visuals by environmental OLs and OLOs.

Considering the **linguistic signs** of the posts, the images were frequently accompanied by the text within them. As shown in Figure 147, 161 of 172 (94%) analyzed images contained

texts. In addition, the text was present in all four analyzed videos. This brings us to the vital role of verbal components within the posted visuals by environmental OLs and OLOs in France. In most cases, the text took a central position: it was highlighted in contrast to the background color (plastic sign) and aimed to inform audiences about fossil fuels, renewable energies, and their regulation.

An additional aim of the text on-image elements was to engage the audiences in discussions. This technique is frequently used in marketing to increase the engagement metrics on social media. In this case study, the OLs and OLOs asked such questions as: 1) *Et dans 10 ans, l'énergie vous la voulez comment ?* 2) *Que faire ? Faut-il sanctionner la Russie et se priver de leur gaz ? Faut-il trouver du gaz ailleurs ?* 3) *Et toi, t'en penses quoi ?* We illustrate these text on-image elements in Figure 148.



Figure 148 Questions engaging audiences in the posts about the energy transition in France

The text played an important role in understanding the obstacles to pro-environmental efforts. Without the textual elements, it could be challenging to concretize the obstacle within the post. We observed three significant obstacles to pro-environmental action in linguistic signs: *actions of companies, state authorities' (in)action*, and problems with the *organization of the action*.

The actions of companies in the linguistic signs in the posts were introduced in captions and the text on-image elements. In addition, organizations frequently used the hashtag #StopTotal to discuss actions by TotalEnergies that harm nature and people. We demonstrate this obstacle category in the examples below. The environmental OLs and OLOs mentioned the following actions of companies, which do not correspond to the sustainable transition: problems with nuclear waste management (Example A), financing of fossil fuels by banks (Example B), not willingness to change by the fossil fuel companies (Example C). The financing of fossil fuels and their financial benefits mentioned in the examples can be linked to the egoistic value item of wealth.

A: [...] Cela, afin pour dénoncer l'irresponsabilité de l'industrie nucléaire et du **gouvernement français qui envoient des milliers de tonnes d'uranium usé en Sibérie sans aucune garantie de reutilization.** [...] (from a caption by @greenpeace 17.11.2021).

B: [...] **Les banques françaises ont injecté \$100 milliards dans les entreprises des énergies fossiles +22% en 2020** [...] (from text on-image by @oxfamfrance, 18.05.2021).

C: Saviez-vous que 100 entreprises sont responsables de 71% des émissions mondiales de CO₂ ? Saudi Aramco, Gazprom, China Energy, ces noms ne vous disent sûrement rien et pourtant ce sont les trois multinationales les plus polluantes de la planète. [...] **Ces 3 géants industriels sont les plus grands responsables du chaos climatique que nous vivons et ils ne comptent pas du tout s'arrêter là puisque polluer rapporte gros.** [...] (from caption by @paloma.moritz, 20.01.2022).

In one post, @amisdelaterre used a popular meme structure to highlight the financial benefits of banks as an indirect obstacle to CC mitigation (Figure 149).



Figure 149 Visual from a post by @amisdelaterre, 10.06.2021

Another category of obstacles implied the *actions of governments and other state authorities*, which do not correspond to the Sustainability Development plan. In particular, the OLs and OLOs emphasized insufficient actions from the government (Examples D and F) or poor management of renewable energies (Example G). One post combined the government's poor regulation of the climate crisis and the banks' financing of fossil fuels (Example E). Finally,

Example H shows that the economic aspect of the climate crisis is well-regulated, and the problems are linked to social and political constraints. These examples show the importance of state authorities' status and social position in the regulation of the climate crisis. However, these actors do not use their authority (egoistic value) to contribute to CC mitigation.

D: Qu'a fait la France pour le climat? **RIEN** (ou presque) (from text on-image posted by @wwffrance, 08.12.2021).

E: [...] pour dénoncer le blabla de Bruno Le Maire, ministre de l'Économie & des Finances, qui refuse de mettre la finance au pas du climat. 🌍 [...] **Les grandes banques françaises financent toujours plus les secteurs polluants.** Depuis 2020, elles ont financé les entreprises des énergies fossiles à hauteur de 100 milliards de dollars, soit +22% par rapport à 2019. [...] (from a caption by @amisdelaterre 26.10.2021).

F: On laisse les petits citoyens réaménager leurs pièces de vie, se critiquer les uns les autres et se faire la guerre de celui qui aura le moins de déchets, la voiture électrique, les panneaux solaires et l'électricité verte. **Ils sont bien là, les dirigeants. Les gestes individuels c'est important et ça leur va si bien. Ils n'ont rien à faire, tant qu'on se regarde les uns les autres.** Et s'il était temps de regarder ensemble dans la même direction, **s'ils prenaient enfin leur responsabilité ?** (from a caption by @les_petits_ecolos, 07.08.2021).

G: [...] S'estimant en retard dans la course à l'armement éolien maritime, **le gouvernement français a accordé à des promoteurs éoliens et des fonds de pension étrangers les plus beaux sites naturels de son littoral et a autorisé des projets d'usines dont l'impact va être colossal,** impossible à compenser et irréversible pour la biodiversité marine, première régulatrice du climat, première productrice d'oxygène et premier puits de carbone de la planète. [...] (from a caption by @ecotalkfrance, 08.12.2021).

H: [...] à présent **les obstacles** pour réduire la pollution carbone **ne sont plus économiques mais** avant tout **politiques et sociaux.** [...] (from a caption by @lesecoplanete, 23.07.2021).

The problems connected to organizing the action mainly considered the impracticality of renewable energies since the transition is too slow and expensive (Example I). The expensive nature of renewable energies can be linked to the egoistic value item of wealth. Besides, some enunciators do not see nuclear energy as a solution to the transition due to their pollution of the environment (Example J). Example J demonstrated a close connection between the obstacle to pro-environmental action and the biospheric value item of preventing pollution.

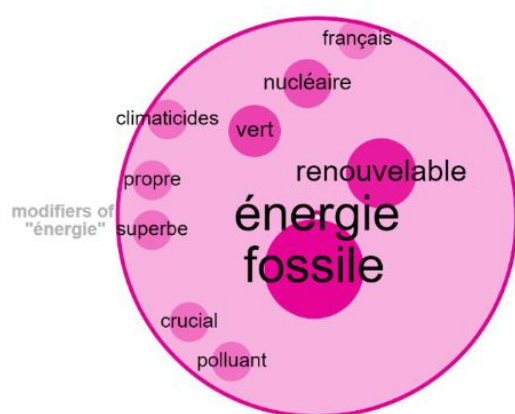
I: [...] **Trop #lent, trop #cher**, le nucléaire est une fausse solution face à l'urgence climatique [...] (from a caption by @greenpeacefrance, 17.01.2022).

J: [...] Mais la production d'électricité d'origine nucléaire pose un problème majeur. **Elle génère des quantités démesurées de déchets** [...] (from a caption by @ecotalkfrance, 23.01.2022).

Besides egoistic values observed in relation to the obstacles in this case study, biospheric and altruistic values simultaneously appeared in several of the posts' texts, yet not always concerning obstacles. For example, @amisdelaterre wrote on 03.03.2022: "En plus de **l'impact environnemental**, ce **projet impacte les droits humains**." Protecting the environment, preventing pollution, helping other people, and social justice were the central biospheric and altruistic values observed in the texts.

During the qualitative multimodal analysis, we observed several tendencies in using words defining the energies. We compared the use of different adjectives in relation to energies with the help of *Sketch Engine* and provide several important examples in the paragraphs below.

With the Word Sketch function of *Sketch Engine*, we visualized modifiers of the noun "énergie" illustrated in Figure 150. The energies were described as *fossile*, *renouvelable*, *verte*, *nucléaire*, *cruciale*, *superbe*, *climaticide*, *polluante*, *propre*, *française*. The adjectives *renewable*, *green*, *super*, and *clean* were frequently opposed to the *fossil*, *nuclear*, *climaticide*, and *polluting*. In fact, fossil fuels and renewable energies were frequently used in the same post as opposing categories: *renouvelable–fossile*, *verte–polluante*, *propre–polluante*.



visualization by  SKETCH ENGINE

Figure 150 Modifiers of "énergie" in the posts by French OLs and OLOs, made with *Sketch Engine*

However, the OLs and OLOs discussed preferably the regulation of fossil fuel energies in their posts. The adjective “fossile” was used in such phrases as *énergie fossile*, *industrie fossile*, *finance fossile*, *gaz fossile*, *entreprise fossile*, *pays pro-gaz fossile*. The adjective “renouvelable” was used only in two phrases: *énergie renouvelable* and *source renouvelable*. We demonstrate these examples with a *Sketch Engine*-generated visualization of nouns modified by *renouvelable* and *fossile* in Figure 151. Although the colors attributed automatically by the tool do not reflect positive or negative connotations, we observed each phrase and can confirm that the adjective *renewable* was used with a positive meaning, while *fossil* generally described criticism or negative connotations.

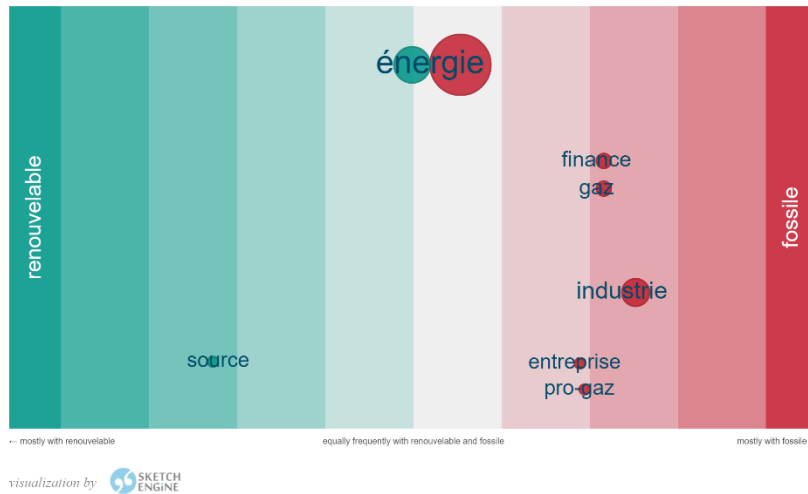


Figure 151 Word Sketch difference between “renouvelable” and “fossile” in the posts by OLs and OLOs in France

In addition, we compared the adjectives “vert” and “polluant” in the selected corpus of posts concerning the energy transition by environmental OLs and OLOs in France. We applied the Word Sketch difference function in the *Sketch Engine* and illustrate the results in Figure 152. The adjective “vert” was frequently used in metaphorical phrases to describe *énergie*, *électricité*, *transition*, *investissement*, *croissance*, *réalité*, *activité*. In these cases, the adjective “vert” signified clean, clear, or sustainable. The nouns modified by the adjective “vert” were generally attributed to solutions or heroes that should contribute to CC mitigation. The adjective “polluant” described such nouns as *secteur*, *énergie*, *entreprise*, *industrie*. In these phrases,

polluting sectors, energies, enterprises, or industries were mainly related to the identified villains in the posts.

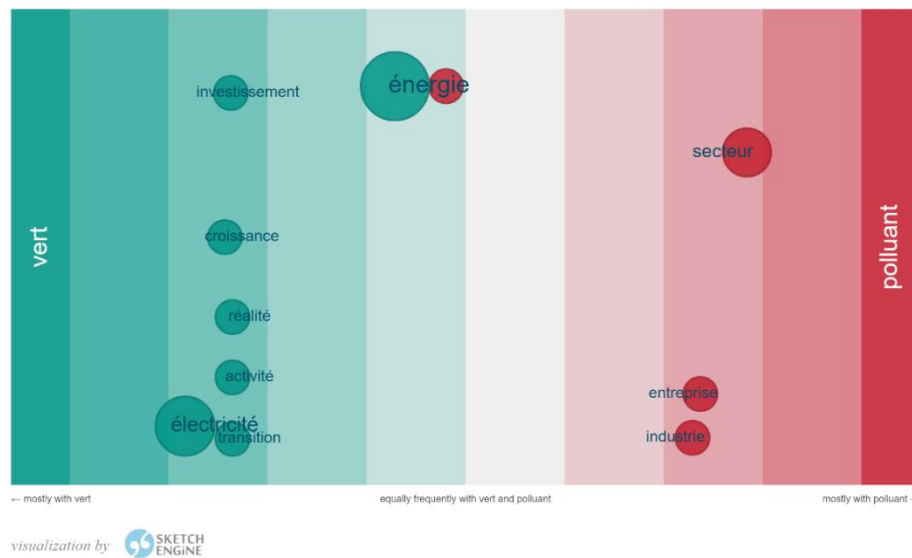


Figure 152 Word Sketch difference of “vert” and “polluant” in the posts by OLs and OLOs in France

To summarize, the obstacles in the iconic signs reflected the actions of fossil fuel companies, state authorities, and banks contradicting SDGs and were represented by images of fossil fuel pipes or plants and politicians. The images of activists represented heroes, while nature was related to victims. The biospheric values in the iconic signs were represented by animals (protecting nature) and emissions from fossil fuels (preventing pollution). Different groups of people manifesting for the benefit of humanity represented altruistic values in the images. The egoistic value of wealth – frequently attributed to the obstacles – was illustrated by money images. The colors attributed to the obstacles were red, orange, and black. The text took a predominant position in almost all analyzed posts. The text emphasized the obstacles and the values in relation to them. The most frequently mentioned obstacles in the posts were linked to the actions of companies (fossil fuel industries and banks), state authorities, and organizations involved in the action. The organization of the action can also be linked to the government’s insufficient action in regulating the energy transition. In general, the adjectives *green* or *vert* and *polluting* or *pollutant* were used in opposition, where everything that was identified as green, clean, or sustainable was attributed a role of heroes, while polluting energies, sectors, industries, or companies were represented as villains in the posts’ captions.

7.4.3 Sentiment analysis of the comments

We applied sentiment analysis of the comments to complement content analysis results and to categorize the positive, mostly positive, neutral, mostly negative, or negative elements within the comments. Sentiment analysis of the comments complemented content analysis, which is provided in the following part, and was used to identify the positive, mostly positive, neutral, mostly negative, or negative elements within the comments. We demonstrated the analysis procedure in Section 4.3.3.2 *Sentiment analysis of the comments*. In this part, we discuss the obtained results considering the comments to the posts by French environmental OLs and OLOs about the energy transition.

The sentiment analysis results of the comments demonstrated that the audiences preferred to use positive elements in their comments since most of the analyzed comments were identified as positive (54,69 %). Table 46 demonstrates the results of the sentiment analysis. Almost a third of the comments were identified as negative or mostly negative. The comments with negative elements were identified to the posts by organizations and individuals in equal proportions.

Table 46 Sentiment analysis results, energy sector France, % of the total number of comments

Bert_Sentiment	Number of comments	% of total
negative	194	17,65%
mostly negative	118	10,74%
neutral	126	11,46%
mostly positive	60	5,46%
positive	601	54,69%
Total	1099	100%

In addition to the sentiment analysis of the comments, we crossed the results obtained from the content analysis (provided in the next section) and the sentiment analysis results. This crossing of the variables demonstrated that the comments identified during the sentiment analysis as “positive” and “mostly positive” almost did not present obstacles in their texts. The obstacles to pro-environmental behavior appeared typically in the comments labeled “mostly negative” (45%) or “negative” (29%) comments, as illustrated in Figure 153.

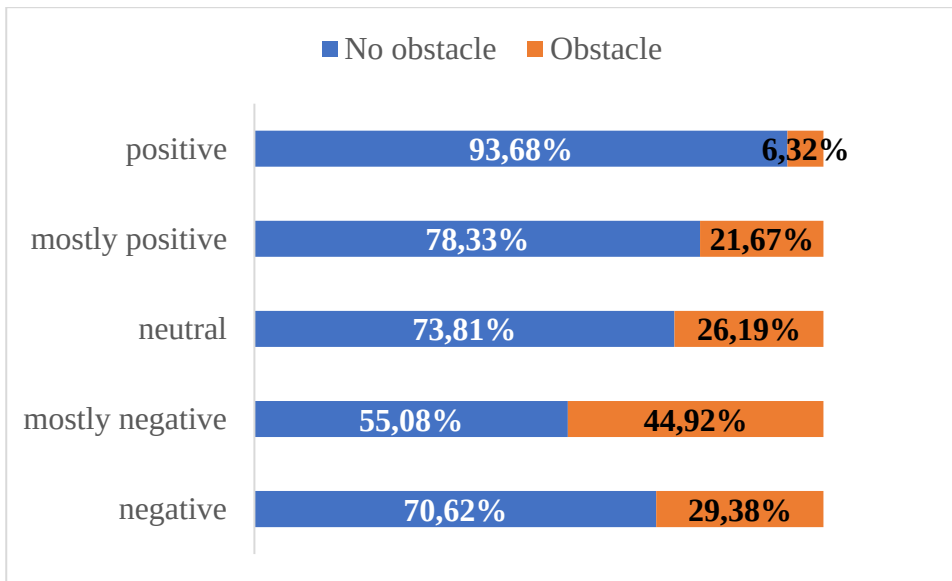


Figure 153 Sentiment-Obstacle relationship in the comments to the posts about energy transition in France

The demonstrated results partially confirm our **Hypothesis 3**:

The sentiment analysis of the comments will reveal messages, including obstacles to pro-environmental behavior or skeptical comments, which will be labeled as “negative” or “mostly negative.”

The obstacles appeared more frequently in the comments, which were labeled “mostly negative” or “negative.” However, a significant part of the comments containing obstacles was also identified as “neutral” (26%) or “mostly positive” (22%) comments, as illustrated in Figure 153. In this context, the sentiment analysis method demands further fine-tuning and validation. The limitations of the sentiment analysis method are discussed in detail in Section 8.2.2 *Limitations of data analyses*.

To summarize, the sentiment analysis of the comments to the posts by French environmental OLs and OLOs regarding the energy sector revealed mainly positive responses from the audiences. However, examining these comments alongside manually identified obstacles demonstrated a complex relationship between the obstacles and the identified sentiments in the comments. Although the majority of the obstacles appeared in the comments labeled as “negative” or “mostly negative,” the comments containing obstacles were also identified in “neutral,” “positive,” or “mostly positive” comments, yet with smaller proportions.

The link between the negative sentiments and obstacles requires additional investigation, and the sentiment analysis model needs to be fine-tuned. In the following part, we discuss the obstacles, the values concerning the obstacles, and the narrative roles present in the analyzed comments.

7.4.4 Analyses of the comments

To study the obstacles, values, and narrative roles in the comments, we applied content analysis, which was, in some cases, combined with computer-assisted linguistic analysis. We explained the detailed analysis procedure in Sections 4.3.3.3 *Content analysis of the comments* and 4.3.3.4 *Computer-assisted analysis of the comments*. In this part, we focus on the comments considering the energy sector in the French subcorpus.

Overall, 194 of 1099 analyzed comments (17,65%) to the posts about the energy transition by environmental OLs and OLOs in France contained the obstacles to pro-environmental behavior. These obstacles were either explicitly or implicitly introduced in the comment's text. By explicitly communicating the obstacle, we understand clearly communicated obstacle to pro-environmental action by the enunciator. Implicitly expressed obstacles suggested but not directly expressed obstacles in the comments and demanded additional knowledge of the post's context. In some comments, we observed a combination of obstacles discussed by the author.

These obstacles were divided into eight categories: organizing the action, state authorities' (in)action, actions of other laypeople, communication and knowledge, actions of companies, feelings and individual conditions, money, and COVID-19. Figure 154 illustrates the numbers of each obstacle category calculated as a percent of the total number of occurrences of the obstacles (N=224). In the following paragraphs, we provide examples of each obstacle category. Where possible, the examples are linked to environmental values.

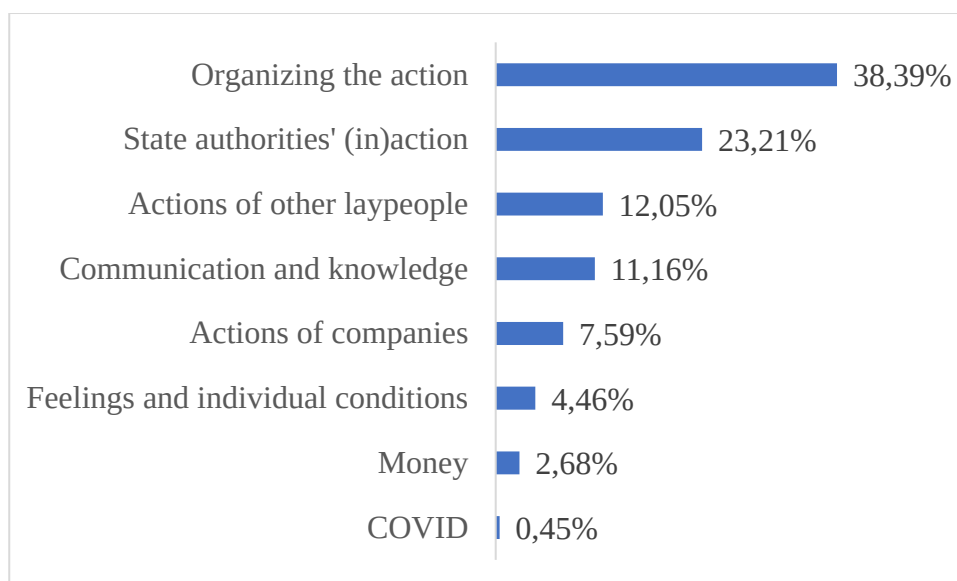


Figure 154 Categories of obstacles in the comments to the posts about energy transition in France

The problems concerning the *Organization of the action* implied mainly negative impacts of windmills and solar panels (Comments B, E, and F), nuclear waste management (Comment C), long-term process of installing windmills (Comment D), problems related to the nuclear energy (Comment D), financial aspects of windmills (Comment F). In most cases, the organization of the action was directly linked to the government's actions. Comment A highlights the long and complicated process of changing energy suppliers, which can also be linked to the money obstacle, where the solution is too expensive for the comment's author. The obstacle in Comment A can be connected to the egoistic value of wealth. Comment B can be linked to the hedonic value item of pleasure. Comments C, E, and F can be linked to the biospheric value item of preventing pollution.

A: Moi j'ai voulu juste m'abonner à EDF,... 3 appels d'1h.... Je suis toujours pas convaincu de ce que j'ai choisi et j'ai l'impression **qu'on va se taper des factures de ouf sans que je puisse faire ni comprendre quoi que ce soit...**

B: L'éolien détruire le paysage, faut trouver une autre alternative à celà..

C: Pas de accord, nous ne pouvons pas penser qu'une énergie soit verte lorsqu'elle **génère des déchets dangereux pour la planète**, dont les effets durent des générations. Les enterrer pendant des siècles est absurde...

D: Bonjour, **il faut entre 8 et 10 ans pour développer un parc éolien en France**. Le projet est très encadré par la réglementation et nécessite plusieurs autorisations. Des

études d'impacts environnementaux sont obligatoires et très poussées. Elles concernent tous les sujets environnementaux, et en grande partie la biodiversité. Concernant les oiseaux, les éoliennes sont très loin d'être leurs plus grands prédateurs, loin derrière les chats et toutes les autres infrastructures urbaines. Aujourd'hui, aucune solution de production d'électricité n'est parfaite, mais nos modes de vie génèrent aujourd'hui d'énormes besoins en électricité (à commencer par cette publication et cette conversation sur Insta. 😊), et si l'on veut y répondre sans augmenter nos émissions de gaz à effet de serre pour limiter le réchauffement climatique, nous n'avons pas beaucoup de choix aujourd'hui. Le nucléaire a, me semble-t-il, son lot d'impacts aussi.. Alors oui, l'idéal serait de changer de paradigme et de diminuer notre consommation, **mais on en est encore loin non** ? Sinon, sachez qu'en général, j'apprécie beaucoup vos publications, qui permettent de communiquer sur de nombreux sujets importants dont il est nécessaire qu'une majorité prenne conscience. Sans rancune donc 😊

E: Je comprend pas comment on peut dire vouloir faire sans le nucléaire actuellement ? Parce que compter sur **les éoliennes et les panneaux solaires c'est tout sauf écologique...** réduire la consommation oui, mais si l'on veut faire sans le gaz, sans le pétrole... ca va être difficile.

F: L'éolien aurait pu faire rêver **mais** c'est tout de même **une aberration, écologique et financière.**

State authorities' (in)action as an obstacle in the comments referred to insufficient efforts from the government or politicians regarding the energy transition. The word "RIEN," frequently used in capital letters, emphasized the audiences' mistrust of governments and political leaders (Comments H–K). President of Nouvelle Aquitaine region, Emmanuel Macron, and Barbara Pompili were criticized for their inaction and were represented as villains (Comments J–K). Interestingly, in many comments, the authors tagged these politicians, which was possibly done to attract their attention to the problem discussed in the post – regulation of fossil fuel and renewable energies. Although the authors of the comments underlined insufficient actions from politicians, some did not specify the actors who should contribute to the solutions (Comment G).

G: Ce n'est aux politiques qu'il faut confier la Planète!!!! On a vu en France nos ministres de l'écologie démissionner un par un....!

H: Sous nos dirigeants actuels, **RIEN** ne changera en faveur du climat, qu'on se le dise. Il est crucial de nous mobiliser massivement et de voter pour un candidat engagé en 2022, AUCUN de Droite.

I: Alors **le gouvernement Français** ne faites pas que parler mais agissez et pour la bonne cause : La Terre . SAUVEZ LA TERRE . PENSEZ A L HUMANITE. PENSEZ A LA FAUNE ET LA FLORE. **CESSEZ VOS PROMESSES QUI NE MENENT A RIEN**. CESSEZ DE NOUS PRENDRE POUR DES IMBECILES .

J: Changement climatique ?? Quel changement climatique ??? Demander au nouveau (l'ancien) **président de région nouvelle Aquitaine ses projets.... rien**. Juste du mépris pour l'écologie. Agir. ... Vite ...

K: @emmanuelmacron @b_pompili L'HISTOIRE VOUS REGARDE, COMMENT OSEZ-VOUS NE **RIEN** FAIRE ????

Actions of other laypeople obstacle category means that actions of other individuals negatively influence the sustainability transition. These actions were typically linked to overconsumption (Comments L–N). The authors of the comments accentuated the importance of comfort, which impacted the inaction. This comfort can be linked to hedonic values.

L: Au lieu de pointer du doigts les dirigeants du pays, **regardons aussi nos façons de consommer** : le dernier Smartphone avec la 5G , les fringues à la mode qui sont usées au bout de 2 lavages, le SUV avec 1 personne dedans en ville, des tomates bio en hiver, des avocats du Pérou, le wifi partout, la digitalisation de tout et de rien, les pelouses bien vertes, la photo Instagram à Santorin et j'en passe. Ne soyons pas spectateurs, soyons de vrais acteurs. **Et au lieu de jeter la pierre construisez un chemin de bon sens au lieu de bétonner vos cerveaux climatisés**

M: Pour moi **tant que l'humain ne changera pas de l'intérieur rien ne changera..** Très peu sont prêt à renoncer à 1/3 de leur confort, **on consomme du vert mais on continue de consommer et consommer...** Je pense qu'il est temps de se bouger le cul nous pour créer autre chose et qu'il faut arrêter d'espérer que des gens qui en ont rien à foutre s'engagent... Ça serait plus rapide que ces 100 riches se bougent mais ça serait moins beau qu'une belle initiative citoyenne mondiale ♡

N: D'accord **mais** ça veut dire une diminution drastique de la consommation et du mode de vie. **Je ne sais pas si 1/10 des gens seraient d'accord de restreindre notre train de vie**. Dommage mais c'est inévitable de continuer dans cette voie jusqu'à la fin je pense même si je serai le premier à revenir à des choses simples, ce n'est pas le cas de tout le monde et je peux le comprendre.

Communication and knowledge-related problems related to the sustainability transition were used as criticisms of NGOs' communication about renewable or nuclear energies. For example, Comment O claimed that there were insufficient explanations from Greenpeace about fossil fuels. Comments P and R authors directly asked to clarify questions about windmills and

alternative energies in general. Comment Q referred to Jancovici's speech about renewable energies in order to blame WWF France for spreading fake information.

O: Ce serait bien d'expliquer le pourquoi du comment. C'est assez énervant de voir Greenpeace faire de grandes annonces sans explication scientifique. **Vous avez un devoir d'explications !** Le Green washing c'est surtout l'utilisation de mot qui ne veulent rien dire. Un petit topo sur les émissions directs / indirect etc. Ca serait sympa

P: Selon certains chercheurs (cf Wedemain) la quantité d'énergie renouvelable accumulées en vaudrait la chandelle...Pourtant **comment arrive-t-on à mesurer l'impact de la modification du milieu marin?** Y a t il une échelle de mesure de la pollution sonore au sein du milieu aquatique? Et la pollution visuelle ?

Q: Fake news pour les énergies renouvelables malheureusement. Je suis très dessus que WWF affirme ce genre d'info. Il suffit de regarder la démonstration de l'expert Mr Jancovici

R: Je suis d'accord ! Quelles sont selon vous les bonnes alternatives s'il vous plaît ? Je me suis renseignée **mais on s'y perd rapidement au final.**

Contrary to the posts, the *actions of companies* as obstacles were not frequent in the comments. The authors of the comments attributed responsibility and blame to companies that do not sufficiently contribute to the energy transition (Comment S). Moreover, these companies' inactions are motivated by financial profits (Comment T) or their promotion strategies (Comment U). In this case, the obstacle was frequently related to the egoistic values of influence and wealth.

S: 100 entreprises responsables de plus de 70 % des émissions mondiales de carbone, donc oui que les particuliers fassent attention c'est bien **mais** malheureusement **ce n'est qu'un coup d'épée dans l'eau.** les plus gros efforts doivent venir des vrais responsables.

T: P.S : **évidemment qu'ils vont chercher à se faire de la thune, évidemment qu'ils vont essayer de faire le minimum,** que y en a plein qui vont résister efficacement, d'autres qui vont nous prétendre qu'une cheminée d'usine est un arbre et que les nouveaux smartphones sont plus écolos, qu'il y a et y aura 50 nuances de vert dans les investissements des banques et co, mais ça c'est l'objet de batailles à mener, et là y a une avenue de cette guerre qui vient d'être ouverte. Je le dis une fois comme ça on est au clair : y aura jamais de victoire décisive mais une série de batailles et des failles à exploiter. On est des nains et ils sont des géants, on pèse rien financièrement, culturellement, structurellement, jamais je prétendrais que "ça y est c'est bon" parce qu'il y a toujours plus de fric à se faire dans le monde tel qu'il est que dans le monde

d'après que j'appelle de mes vœux. **Parce que nos victoires de preservation du vivant sont toujours temporaires quand les leurs, destructrices, sont trop souvent définitives.**

U: 🙌🙌🙌🙌 en + des energies fossiles **j'en peux plus des ecrans à chaque station total** qui doivent consommer bcp d'énergie et qui nous cassent les oreilles avec leur pub

Feelings and individual conditions were not frequently mentioned in the comments and generally reflected personal feelings of anxiety or helplessness due to social judgments or pressure (Comment V). This obstacle category was not directly linked to the energy sector but more to climate action in general.

V: MERCI ! pour votre tolérance, votre humilité, votre bienveillance... c'est tout ce dont j'avais besoin aujourd'hui. J'ai encore du mal à y croire vraiment, **c'est tellement difficile de se détacher de ses pressions** lorsqu'on a tendance à être un peu trop exigeant avec soi, je suis envahi de ses sentiments, surtout dans ma vie professionnelle... mon mari me dit souvent "le mieux est l'ennemi du bien" ♥

The *money* obstacle category signified insufficient financial resources for individuals to choose environmentally responsible energy providers (Comments W–Y). This obstacle category is directly connected to the egoistic value item of wealth.

W: Arf dommage, je viens de faire la simulation (très rapide en effet 😊) **mais on est à 60euros de plus qu'avec EDF** :/

X: Ilel aussi pour moi **mais le gaz a triplé** depuis la fin d'année donc **je vais devoir recharger** 😞

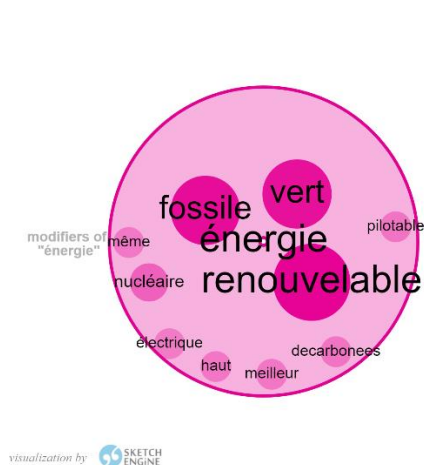
Y: YES! Ilel ici aussi... 🙄 , enfin pour l'électricité. parce que pour le gaz, **notre facture ayant triplé, on ne pouvait plus suivre.** on a dû revenir chez Engie.

The *COVID-19* crisis as an obstacle appeared in one comment only, where it was used as a generalized obstacle for the government's and people's inactions. In Comment Z, the author specified this deceleration and highlighted the role of industries that should contribute to CC mitigation.

Z: [...] **j'ai l'impression que le Covid a tout stoppé, les gouvernements et le reste.** C'est une bonne excuse pour ne rien faire. Ils « ont d'autres chats à fouetter ». Le vrai changement viendra des industriels. Ils sont capables en plus, quand on voit que

l'interdiction des pailles en plastiques a mis des années à passer alors qu'en 6 mois, ils avaient tous trouvé une alternative... je ne sais pas quel pourrait être le levier...

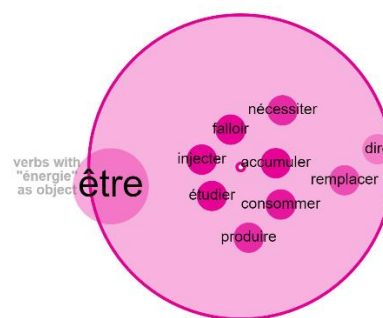
To complement the content analysis of the comments and to observe specific patterns, we visualized several tendencies observed in the comment data. As in the posts' data, we visualized modifiers of *énergie* with the Word Sketch function in *Sketch Engine*. The results showed that the word “*énergie*” was described in the comments as *renouvelable*, *fossile*, *verte*, *pilotable*, *décarbonée*, *meilleure*, *haute*, *électrique*, *nucléaire*, and *même* (Figure 155). In addition to this, we visualized the verbs that used “*énergie*” as an object, which included *être*, *injecter*, *falloir*, *nécessiter*, *étudier*, *produire*, *consommer*, *remplacer*, *accumuler*, and *dire* (Figure 156).



visualization by SKETCH ENGINE

Figure 155 Word Sketch of modifiers of “*énergie*” in the comments to the posts by environmental OLs and OLOs in France

énergie



visualization by SKETCH ENGINE

Figure 156 Word Sketch of verbs with “*énergie*” as object in the comments to the posts by environmental OLs and OLOs in France

To observe specific patterns in obstacles, we visualized the use in the context of the conjunction “*mais*” with the Concordance function in *Sketch Engine* (Figure 157). We observed that “*mais*” appeared 102 times in the comments. 43 times “*mais*” was directly related to different obstacle categories. We illustrate several examples in Figure 157.

Details	Left context	KWIC	Right context
1 ① missions mondiales de carbone, donc oui que les particuliers fassent attention c'est bien		mais	malheureusement ce n'est qu'un coup d'épée dans l'eau. les plus gros efforts doivent ve
2 ① is sont selon vous les bonnes alternatives s'il vous plaît ?</s><s>Je me suis renseignée		mais	on s'y perd rapidement au final.</s><s>Sans compter les actions pour Total et Cie ... Ptd
3 ① ible de changer 😊 Arf dommage, je viens de faire la simulation (très rapide en effet😊)		mais	on est à 60euros de plus qu'avec EDF / !Ilek aussi pour moi mais le gaz a triplé depuis le
4 ① penser la manière de se fournir en énergie, de développer encore plus les alternatives :		mais	qui veut une éolienne aujourd'hui dans son jardin ou à proximité ?</s><s>Idem pour les
5 ① le ni continu.</s><s>Pour lisser et piloter les renouvelables, il faut maîtriser l'hydrogène		mais	aujourd'hui, il provient des énergies fossiles et non de l'électrolyse de l'eau.</s><s>Il est
6 ① ont une vraie utilité une solution pour les déchets c'est de créer des centrales à protons		mais	comme aucun politique français n'a eù le cran d'accepter cette solution existant depuis fi
7 ① onees c'est produire tout ce que j'ai cité.</s><s>Les énergies renouvelables c'est super		mais	c'est pas suffisant, on a besoin du nucléaire.</s><s>Bonjour, il faut entre 8 et 10 ans poi
8 ① aussi).</s><s>Le charbon pollue l'atmosphère... L'hydraulique est une bonne alternative		mais	il faut créer des barrages... Certes le nucléaire peut faire peur, mais elle est pour le mom
9 ① rgera..</s><s>Très peu sont prêt à renoncer à 1/3 de leur confort, on consomme du vert		mais	on continue de consommer et consommer... Je pense qu'il est temps de se bouger le cu
10 ① nt du nucléaire, le seule remplaçant efficace au nucléaire est le charbon ou la biomasse		mais	ceci sont bien plus polluant et apporte sont un danger pressant.</s><s>Il n'y à pas de sc
11 ① chauffage climatique On comprend bien que les déchets nucléaires sont un problème		mais	en France on ne peut pas faire autrement.</s><s>De plus que c'est un marché économi
12 ① inète mais un moment, faut être réaliste.</s><s>Le problème c'est pas le gouvernement		mais	le peuple surtout français... Dès qu'on veut mettre des éoliennes, sa gueule... quand est
13 ① jurée de vie est dépassée ?</s><s>Les énergies renouvelables sont certes une solution		mais	malheureusement elles restes polluantes, surtout pour le photovoltaïque et l'éolien où là

Figure 157 Use in the context of “mais” made with Concordance function in Sketch Engine, comments data about energy in France

Figure 157 demonstrates different obstacle categories, such as organizing the action or not sufficient action (line 1), feeling on being lost with the amount of information about alternative energy sources (line 2), expensive renewable energies (line 3), controversial solutions of using hydrogen coming from fossil fuels (line 4), organizing the action (line 5 and 11), insufficient political action (line 6), insufficient renewable energy sources (line 7), not adapted infrastructures of hydraulic energy (line 8), actions of other people (line 9 and 12), not efficient and polluting energy sources (lines 10, 13). In two comments, the authors used such structure as “C’est bien/super **mais**” (lines 1,7), where the author starts from a positive statement and continues with a description of an obstacle.

The word “juste” was used in several comments to emphasize the meaning of the obstacle. In the examples below, the *juste* was used in such meanings as *simplement* or *seulement*. We illustrate the word “juste” in use in Figure 158, where lines 1, 3, and 4 reflect organizing the action obstacles, and line 2 illustrates the actions of companies.

Details	Left context	KWIC	Right context
1 ① ons opté pour ilek aussi à emménagement dans notre nouvelle maison 😊 Moi j'ai voulu		juste	m'abonner à EDF.... 3 appels d'1h.... Je suis toujours pas convaincu de ce que j'ai choisi
2 ① :s>Et on sanctionné Total Énergie pour choisir ses profits au détriment de la vie.</s><s>		Juste	une question de cohérence entre les discours et le actes.</s><s>Bien sûr il faut trouver c
3 ① tu de demande électrique des pays développés Si nous sortons du nucléaire nous allons		juste	augmenter nos conso de gaz naturel et/ou de charbon Pour info le gaz c'est 430gCO2e/k
4 ① d !!</s><s>Que des paroles en l'air aucune action concrète comme d'habitude 😊 Après		juste	... Inscrire quelque chose dans la loi, c'est très très long.</s><s>Ça prend des mois.</s>

Figure 158 Use in the context of “juste” made with Concordance function in Sketch Engine, comments data about energy in France

In several comments, the word “problème” was directly linked to the obstacles. Figure 159 demonstrates 7 extracts, where the obstacles were linked to actions of governments and

companies (lines 1, 2, 3, 4), organization of the action (lines 5, 6), and actions of other people (line 7). In lines 6 and 7, the words *problème* and *mais* are used in the same phrases. In line 6, the *mais* in the sentence can diminish the significance of the existing problem, while in line 7, *mais* draws attention to the villains.

Details	Left context	KWIC	Right context
1	it triplé, on ne pouvait plus suivre. on a dû revenir chez Engie.	Nous parlons d'un problème	connu depuis les années 70 et ce qui se passe actuellement avec l'Ukraine était à prév
2	stes le pen/zemmour Sans réflexion du gaspillage et de la décroissance energetique...	le problème	reste entier...Avant de changer de système de production d energie nous devons chang
3	ausier d'immenses dégâts humains et matériels.	Ils constituent aussi un véritable problème	en terme de continuité écologique et sédimentaire (même si il existe y a des solutions à
4	e que les gens ont envie d'avoir des champs d'éoliennes à perte de vue ????	Le problème	c'est qu'il y a bien longtemps qu'il aurait fallu anticiper la fermeture de certains sites nucl
5	nalheureusement et obligatoirement transmis aux générations futures.	Régler un problème	urgent et immédiatement créé malheureusement d'autres problématiques parfois durabl
6	face au réchauffement climatique On comprend bien que les déchets nucléaires sont un	problème	mais en France on ne peut pas faire autrement.
7	du pétrole... Je veux bien aider la planète mais un moment, faut être réaliste.	Le problème	c'est pas le gouvernement mais le peuple surtout français... Dès qu'on veut mettre des é

Figure 159 Use in the context of “problème” made with Concordance function in Sketch Engine, comments data about energy in France

Another observed pattern in the comments used the phrase “certes ... mais” as a marker of opposition and concession. This can be illustrated by Figure 160, where the obstacles are linked to the use of nuclear energies (lines 1–3) and renewable energy sources, specifically solar panels (line 4).

Details	Left context	KWIC	Right context
1	l'atmosphère... L'hydraulique est une bonne alternative mais il faut créer des barrages...	Certes	le nucléaire peut faire peur, mais elle est pour le moment la seule énergie avec un très br
2	xe, c'est navrant.. le nucléaire est une solution à la réduction démission de CO2.	Certes	il y a des points négatif mais a regarder le rapport effets positifs/négatifs malgré votre inc
3	plus polluant et apporte sont un danger pressant.	Il n'y à pas de solution miracle, certes	le nucléaire peut amener des problèmes très grave, mais en comparaison le CO2 est un
4	ennes lorsque leur durée de vie est dépassée ?	Les énergies renouvelables sont certes	une solution mais malheureusement elles restes polluantes, surtout pour le photovoltaïq

Figure 160 Use in the context of “certes... mais” made with Concordance function in Sketch Engine, comments data about energy in France

The word “même” was used as an emotional marker in several examples to highlight the hypothetical nature of the obstacle or concession (Figure 161). This word was used to discuss political inaction (line 1), organizing the action (lines 2, 3, 4), actions of other laypeople (line 5), and actions of companies (line 6). In the examples below, *même* is used in such phrases as “*même pas*,” “*même si*,” and “*même + gerund*” (e.g., *même en ayant*) to strengthen the emotional coloring of the sentences.

Details	Left context	KWIC	Right context
1	① ument climatique, sujet suivant, une intervention des politiques à ce sujet, rien, que dalle,	même	pas un nous allons accélérer la transition 🇫🇷, les priorités sont apparemment ailleurs, affi
2	② rstituent aussi un véritable problème en terme de continuité écologique et sédimentaire (	même	si il existe y a des solutions à ça).</s><s>Il me semble que les éoliennes sont problémati
3	③ soir !</s><s>Faut pas croire, l'énergie qui arrive à la maison vient toujours du nucléaire,	même	en ayant un "fournisseur" d'elec verte ... Bien faire attention que ton abonnement chez lle
4	④ à métier on a pu discuter avec eux des dessous de leurs différents slogans.</s><s>Donc	même	en étant abonné à llek, tu consommes de l'énergie fossile... après il faut aussi se renseig
5	⑤ s><s>Dommage mais c'est inévitable de continuer dans cette voie jusqu'à la fin je pense	même	si je serai le premier à revenir à des choses simples, ce n'est pas le cas de tout le monde
6	⑥ <s>Les poissons d'élevage polluent énormément aussi.</s><s>Le plastique on en parle	même	pas, il a son très mauvais rôle aussi, et issu des énergies fossiles .</s><s>Donc en tant r

Figure 161 Use in the context of “même” made with Concordance function in Sketch Engine, comments data about energy in France

To summarize, although only 17% of the comments discussed obstacles in direct or indirect forms, we could still observe several categories of obstacles regarding the energy sector that were discussed by the audiences of environmental OLs and OLOs in France. These obstacles mainly referred to organizing the action, state authorities’ (in)action, and actions of other laypeople. Renewable and fossil fuel energies were frequently opposed in the comments. Although most obstacles were linked to egoistic values, several comments emphasized the negative impacts of renewable energies on the environment, which demotivate them to use or support these energies. Several linguistic markers of obstacles were observed in this case study, such as *mais*, *juste*, *problème*, *certes* ... *mais*, and *même*.

7.4.5 Discussion and summary of the results

In this part, we summarize and reflect on the results from our mixed-method study of Instagram posts and comments to them concerning the energy transition from fossil fuels to renewable energies discussed by French environmental OLs and OLOs in January 2021–March 2022. We combined multimodal discourse analysis with computer-assisted linguistic observations to investigate the trends and specific patterns in the posts. We applied a three-method approach to study the comments: sentiment analysis, content analysis, and computer-assisted linguistic analysis. This mixed-methods research design allowed us to overview the multimodal data in a broader sense and to provide specific trends and patterns regarding the obstacles to pro-environmental action, environmental values concerning these obstacles, and narrative roles that appeared in the posts and the comments.

Previous studies have demonstrated a relatively low number of fossil fuel-related tweets by NGOs or social movements in relation to COP21 in 2015 (Hopke & Hestres, 2018). More recent observations of Twitter data claimed that tweets about renewable energies have increased rapidly since 2015, particularly in the discourse by fossil fuel companies such as Shell,

ExxonMobil, BP, or TotalEnergies (Si et al., 2023). In our study, only 17% of Instagram posts from the French subcorpus about the food, energy, and transport themes covered the energy theme, and even less discussed the obstacles to CC mitigation. In fact, the technology industries, such as fossil fuels, nuclear energies, or renewable energies, are less discussed in influencers' communication (Paço & Oliveira, 2017). However, we suppose that the number of posts about the energy transition by environmental OLs and OLOs has risen since the beginning of the war in Ukraine in February 2022.

The analyzed posts typically used the following components: identifying the problem, attributing responsibility and blame, and proposing solutions or opportunities. These main components can be linked to diagnostic, prognostic, and motivational frames developed by O'Neill et al. (2015) and Painter et al. (2018). These thematic frames are frequently applied in communication research to study climate activism (Molder et al., 2021; Samofalova & Marcella, 2023; Svensson & Wahlström, 2023).

To discuss the sustainability transition in the energy sector, the environmental OLs and OLOs predominantly used two types of images in their posts: illustrations and knowledge images (Catellani, 2018). Illustrations were used to support the post's caption reporting the climate campaigns, marches, civil protesting actions, or political meetings. The posts with such visuals were shared in relation to significant climate events, such as climate marches or COP meetings. Besides, such illustrations in the posts of environmental OLOs reflected the images of the "fight" for the climate and humanity (biospheric and altruistic values).

The illustrations contained elements of ethical images portraying heroes, as suggested by Catellani (2018). Furthermore, such illustrations can be linked to the purposeful images category proposed by San Cornelio et al. (2024), where the visual narrative encourages audiences to contribute to the solution. Indeed, the texts within the image and the posts encouraged the viewers to engage in protesting action or to join the climate movement. In this case study, as in the study of the posts about the energy sector in Belgium (cf. Section 7.3.5 *Discussion and summary of the results*), we name these visuals purposeful illustrations since their main aim was to support the posts' captions, which attempted to engage the audiences in climate action. The purposeful illustrations posted by environmental OLOs were more frequently liked and commented if they contained text-on-image elements. The most frequently liked and commented purposeful illustrations shared by OLs included mainly photos of individuals and their personal experiences. These results correlate with previous studies in

communication research, where narrative personal images positively influenced the engagement rate of Instagram posts (Romney & Johnson, 2020). We demonstrate several examples of purposeful illustrations in this case study in Figure 162.



Figure 162 Purposeful illustrations in the posts about the energy transition by environmental OLs and OLOs in France

Environmental OLOs frequently used infographics or knowledge images in this subcorpus. They included visual representations of specific statistics or explicative texts about renewable energies, fossil fuels, and banks financing fossil fuels. The banks financing fossil fuels was a primary obstacle to the energy transition in the analyzed posts. Although infographics are prevalent in communication by climate scientists and news media (M. Schäfer & Xiaoyue, 2023), in this case study, they were used mainly by the environmental OLOs as a rhetoric strategy (Catellani, 2022). Following the visual typology by Catellani (2018), we call these visuals knowledge images since an image can be used as a cognitive tool. Figure 163 visualizes several knowledge images that appeared in this case study.



Figure 163 Knowledge images in the posts about the energy transition by environmental OLs and OLOs in France

In addition to static knowledge images, @litapointco introduced a novel form of visuals – dynamic infographics. We define dynamic infographics as infographics shared as Reels videos providing information about financial aspects related to fossil fuels. We illustrate several frames from such dynamic infographics in Figure 164. Although this type of visual represents

information in a vivid and innovative format, such dynamic graphic representations can be perceived as non-credible information by different audiences and, therefore, communicators “need to assure that such visuals do not distract or confuse viewers” (N. Li et al., 2018, p. 16).



Figure 164 Dynamic infographics (from a post by @litapointco, 13.04.2021)

In a few posts, the environmental OLs and OLOs used memes to communicate satirically about the energy transition and the CC-related issues. These memes can be linked to spectacular image types proposed by Catellani (2018) and significantly influence climate activism and public discussions on social media (Adiga & K., 2024). Specifically, memes about CC issues can positively influence civic engagements (B. Zhang & Pinto, 2021) and strengthen online communities (Johann et al., 2023).



Red, orange, and black colors were linked to the obstacles to CC mitigation in the plastic signs. In several dramatic settings, these colors can potentially increase a feeling of anxiety or fear in the audiences, which may be less effective than a positive framing of CC-related issues (O’Neill & Nicholson-Cole, 2009). However, a recent study of audiences’ perceptions of hope and fear in CC visuals claimed that this division into hopeful or fear-driven communication strategies is overstated (Ettinger et al., 2021). In this case, we suggest that communicators test different color schemes in their communication and adapt them according to the audience’s reactions.

The linguistic signs of Instagram posts included observations of the textual elements from posts' captions and images. Overall, the role of text in this case study is significant: besides posts' captions, 94% of analyzed images contained verbal elements. In several posts, the environmental OLs and OLOs used questions in their visuals, inviting their audiences to discuss the future of energy and policies in the comments. Since the audiences frequently commented on these posts, we may suggest that this technique could increase potential audience engagement. Overall, the text-on-image elements were essential in the identification of the obstacles and the values in relation to them since the verbal component provided a contextual and more concrete representation of obstacles and values, which confirms our **Hypothesis 2:**

The obstacles will be more clearly stated in the verbal mode of the posts, i.e., captions or text-on-image elements, on Instagram.

In the analyzed posts, we identified several obstacle categories: actions of companies, state authorities' (in)action, and problems with the organization of the action. Only 17% of the comments included directly or implicitly expressed obstacles. However, the results from the comment analysis demonstrated a more extensive palette of obstacles than those of the analyzed posts. The obstacles in comments included the problems related to organizing the action, state authorities' (in)action, actions of other laypeople, communication and knowledge, actions of companies, feelings and individual conditions, money, and COVID-19. As in the work by Rochyadi-Reetz et al. (2019), renewable energies were discussed in relation to economic and technical problems in this case study. Interestingly, in the posts, renewable energies were considered economically beneficial, while in the comments, the audiences highlighted higher prices for using renewable energies in households. The technical problems can be linked to a long development process and installments of windmills and solar panels, as discussed in the comments.

Although recent studies have emphasized the vital role of renewable energies “for achieving a sustainable and clean energy future” (Hassan et al., 2024), the communication about this issue is still ambivalent in some posts in this case study. Several comments mentioned controversial communication about renewable energies as an obstacle to the energy transition. Indeed, there is a significant gap in addressing public concerns when communicating about renewable energies (H. Lucas et al., 2021).

Most obstacles in the posts and comments referred to the egoistic values of wealth and authority. Nevertheless, we noted an emergence of biospheric and altruistic values in relation

to several obstacles. Indeed, one post considered renewable energies harmful to nature (biospheric value item) and human rights (altruistic value). In addition, several comments emphasized the negative impacts of renewable energies on the environment, which demotivate them to use or support these energies. Considering that biospheric values were also linked to the obstacles in the posts, yet in smaller proportion, we can not fully confirm our **Hypothesis 1**:

The obstacles to pro-environmental behavior in both posts and comments to them will be predominantly referred to the egoistic or hedonic values.

Previous research demonstrated a “quasi-absence of heroes in CC discourse” (Gjerstad & Fløttum, 2021). However, this case study provided us with long lists of different narrative roles described in the posts and the comments, including heroes, victims, and villains, which can be explained by the narrativity largely present on Instagram (Kozharinova & Manovich, 2024). We synthesized these narrative roles in Figure 165.

Figure 165 demonstrates different individual actors, group entities, energy sources, or geographical territories as heroes, villains, and victims. The iconic signs in the posts concentrated around the representations of humans, fossil fuels, and renewable energies. The images of humans reflected people at the protesting actions, who were represented as heroes and political leaders, i.e., Emmanuel Macron specifically, as villains – criticized for their irresponsible position toward the climate crisis. In linguistic signs precisely, politicians and government were closely linked to the narrative role of *past and current villains – potential future heroes* as proposed by Gjerstad & Fløttum (2021). In all cases, fossil fuels were represented as villains in the visuals.

In most posts and comments, fossil fuels and renewable energies were often opposed, where renewable energies were described as clean or green and fossil fuels as dirty or polluting. However, renewable energies took an ambiguous position in one post and most comments. One post highlighted the negative impacts of renewable energies on the environment, yet it was mainly described in the caption and text on-image (linguistic sign). The images with nature elements included mainly sea and sea animals, represented as victims of renewable energies. This opinion was supported in the comments to this post. Besides, multiple comments to other posts emphasized the harmful effects of manufacturing and installing windmills and solar panels.

			
Posts	Energies: nuclear energy, energy supplier (ILEK), renewable energies, windmills Individuals: you (the readers), everyone, myself, politicians Group entities: banks (Crédit Coopératif), climate movements and activists (Amis de la Terre, Alternatiba Paris, Fridays for Future Uganda),	Individuals: myself, people Nature: biodiversity, forests, ecosystems, climate, environment, oceans Geographical territories: Siberia, Uganda, Tanzania, Lorraine, Moselle	Energies and companies: Saudi Aramco, Gazprom, China Energy, TotalEnergies, windmills, fossil fuels, Iberdrola, energy industry, nuclear energy, coal, nuclear waste, gas, coalbed methane (gaz de couche), energy from woodburning Individuals: politicians (Emmanuel Macron, Vladimir Putin, Bruno Le Maire, Aurore Bergé) Group entities: Louvre museum, banks (Société Générale, BNP Paribas, Crédit Agricole, Banque Populaire, Banque Postale, European Central Bank), ASN (L'Autorité de sûreté nucléaire), the EU, airline industry, the European Commission, government, COP26 Geographical territories: Russia, China, France Other: technical progress
Comments containing obstacles	Energies and companies: nuclear energy, oil from French fries, solar panels, Total, petrol Individuals: we, Jancovici, powerful people, politicians (Emmanuel Macron), you, scientists, myself, wealthy people, involved people, activists, everyone or all people, humans Group entities: government, museums, companies, industries, Other: YouTube channel Dimensions débat,	Nature: planet, environment, ecology, Earth, flora, fauna, ecosystems, sea, forests, nature, climate, biodiversity, landscapes, birds, world People: children, people, future generations, French citizens, grandchildren, humanity, myself, Geographical territories: country, Alsace, Madagascar, France Energy suppliers: ILEK	Energies and companies: windmills, solar panels, energy suppliers (Total, Gazprom, ILEK, BULB, EDF), coal, nuclear energy, renewable energies, gas, all energies, green energy, fossil fuels, hydroelectric energy, tankers, methanizer Individuals: us/all people, you, politicians (Emmanuel Macron, Barbara Pompili), business owners (Jeff Bezos, Bernard Arnaud), eco-activists, COP visitors Group entities: the EU, Greenpeace, government, lobbies, ministers, COP26, WWF France, shipping companies, industries, social media, banks, media, Parisian administration, local authorities, Geographical territories: India, China, Germany, Spain, United Arab Emirates, Russia, Other: algorithms, paperwork, capitalism

Figure 165 Narrative roles in the posts by environmental OLs and OLOs in France

Although most of the obstacles in posts and comments discussed fossil fuels and renewable energies as opposing energy sources, nuclear energy also appeared in several comments. Communication about nuclear energy is particularly interesting due to its capability to activate

different types of discursive production and serve as a “rhetorical trigger” (Catellani, 2016). In this case study, some comment authors saw nuclear energy as a potential hero, while others criticized its development because it can lead to negative consequences in case of problems.

The sentiment analysis revealed a high number of positive or mostly positive comments (60%). However, compared to food and transport themes, the energy-related comments in France were more frequently labeled as “negative”: 27% of the comments were labeled as “negative” or “mostly negative.” These negative sentiments can be characteristic of the energy discourse about fossil fuels present on social media (Debnath et al., 2023). After crossing the sentiments and obstacles variables in the comments, we noted that the obstacles appeared more frequently in the comments labeled “mostly negative” or “negative.” Yet, in smaller proportions, the obstacles were present in comments labeled as positive or mostly positive. This result partially confirms our **Hypothesis 3**:

The sentiment analysis of the comments will reveal messages, including obstacles to pro-environmental behavior or skeptical comments, which will be labeled as “negative” or “mostly negative.”

In addition to the trends and patterns in visual discourse described at the beginning of this part, we identified several linguistic markers of obstacles in the posts and the comments. These markers include such words as *mais, juste, problème, certes ... mais*, and *même*. The identified markers are similar to findings in linguistics research (Fløttum et al., 2019; Fløttum, Gjerstad, & Oloko, 2021). The markers “mais,” and “certes ... mais” introduced polemical discourses, which can differ from mild to stronger forms of criticism.

To summarize, the mixed-method research design was optimal in this case study to examine the patterns and trends in communication about renewable and fossil fuel energies by environmental OLs and OLOs in France. Multimodal discourse analysis allowed us to identify the trending types of visuals that may be adopted by communication practitioners. The major obstacles mentioned in the posts were linked to the companies’ and government’s activities, which, according to the environmental OLs and OLOs, are not in line with the SDGs. These obstacles were mainly introduced in the verbal mode of the post yet supported by different visual elements, such as red or black colors. In the comments, the audiences specified poor infrastructures and adoption of renewable energies, their high prices, insufficient actions from the government, or communication-related issues. In several comments, nuclear energy was considered a potential solution to the climate crisis, while renewable energies were considered

inefficient and harmful to the environment. Although most of the obstacles were linked to egoistic values, as in the studies in environmental psychology (Bouman et al., 2018; Bouman, Van der Werff, et al., 2021), several obstacles concerned biospheric value items of protecting nature and preventing pollution.

These findings open new horizons in communication about the energy transition. The audiences' responses demonstrated a certain level of mistrust or disbelief in renewable energy sources due to their impracticality or high prices and negative impacts on the environment and people's lives. Furthermore, the inconsistent or even controversial solutions proposed by the government and politicians were highly criticized in the comments and the posts. We suggest that more concrete communication about renewable energies could positively influence audiences' perceptions of renewable energies. It can be done by providing information about the construction of windmills or solar panels, their environmental impacts, and the recent technological advances in reducing negative environmental impacts. More practical recommendations for communicating about the energy transition are resumed in Section 8.3.1 *Implications for communication practitioners.*

7.5 Reflecting on the mixed-method case studies

This part concentrates on our synthesis and remarks concerning the mixed-method case studies. We start with the reflections on general observations of the posts' themes. Then, we summarize the observed obstacles in the posts and comments to them from the case studies, followed by the discussion of the obstacle-values relationships and narrative roles in line with the literature review and the most recent studies. We reflect on the specificities of investigating Instagram data for each analyzed element where possible.

To some extent, environmental OLs and OLOs adopt previously proposed communication strategies, such as solution-oriented communication (Corner et al., 2015). Our data has demonstrated a wide range of individual and collective actions for CC mitigation in the food, energy, and transport sectors. This contradicts previous research results indicating that individual solutions and personal behavior frames were not frequently communicated on social media (Hopke & Hestres, 2018). The majority of the analyzed posts in the case studies were more solution-oriented than obstacle-oriented. Indeed, the environmental OLs and OLOs in Belgium, France, and Norway generally contextualized the situation around CC mitigation and proposed different solutions, which, in turn, contributed to relatively positive reactions from the audiences (S. O'Neill et al., 2013). Such solution-oriented visual discourses can produce positive responses from audiences and less polarization (Chapman et al., 2016).

The presence of solution-oriented posts can possibly explain a relatively small number of negatively labeled comments by sentiment analysis and comments discussing the obstacles to CC mitigation identified with the help of content analysis. Another possible reason for a relatively small number of obstacles in the comments can be related to confirmation bias – the process of interpreting information in alignment with preexisting beliefs while disregarding contradictory evidence (Nickerson, 1998). It is possible that the readers of the Instagram posts by selected environmental OLs and OLOs share similar views with the enunciators and, therefore, do not express contradicting or criticizing opinions in the comments. Finally, more recent studies on other social media, e.g., Twitter, have shown a trend in positive sentiments in tweets (Repke et al., 2023) and low levels of polarization and conspiratorial content about CC-related issues (Dubey et al., 2024), which can indicate a common agreement on CC issues or the platform regulation of controversial messages. The studies by Repke et al. (2023) and Dubey et al. (2024) covered the period till 2022; however, the situation could have changed.

As in the study by Perea, Bonsón, and Bednárová (2021), our findings demonstrated that still images on Instagram achieved a higher number of likes while video posts positively influenced the number of comments to them. Illustrations, including portraits of heroes (ethical images) or villains, and knowledge images, containing informative textual elements, were the most frequently used types of visuals. Nevertheless, the posts with illustrations of personal experiences in all case studies obtained the highest numbers of likes and comments, which may be explained by the authenticity of content about personal experiences directly influencing the increase in engagement rates (de Brito Silva et al., 2022).

The images that we called knowledge images included text as a significant element of the visual and can be referred to as technographismes, as defined by Paveau (2019). Our study has demonstrated that such images incorporating texts go beyond political communication (Paveau, 2019) and are frequently used by environmental OLO and OLs representing activists and people pursuing creative professions. This increasing presence of text in Instagram posts can indicate the platform's transition "from a more private and performative space to a more public, discursive one" (M. Schreiber, 2024, p. 12). In addition, Instagram was previously considered a visually oriented platform with aesthetically attractive imagery (Manovich, 2016; Pearce et al., 2019). In our study, the images were diverse, and it would be difficult to name most of them as aesthetically attractive.

The most frequently discussed obstacles in the posts by environmental OLs and OLOs reflect the actions or inactions by the governments, companies, and industries in the food, energy, and transport sectors. The inactions of national governments and companies were specified as barriers to the sustainability transition by other studies in social sciences (Berg, 2019; Lawrence, 2020). However, the audiences of the analyzed posts mentioned mainly different personal barriers to adopting environmentally friendly practices. These personal barriers included problems with the organization of the action in general, actions or opinions of other people, and personal health. These obstacles can be linked to the classification of internal barriers by Stankuniene, Streimikiene, and Kyriakopoulos (2020). The internal or individual barriers include social and psychological barriers, knowledge-based barriers, unconscious behavior, and lack of motivation (Stankuniene et al., 2020).

The audiences of each case study emphasized the essential role of educating people about the existing solutions and communicating about the solutions in the media. In fact, according to the audiences, eating less meat, using electric vehicles, and using renewable energy

are controversial topics that are not clearly communicated by the media and organizations. Such discussions of personal experiences appeared more frequently in the comments to the posts by environmental OLs than OLOs. It can be explained by a particular level of trust and confidence in OLs by their audiences (Turcotte et al., 2015).

The previous studies revealed a relatively low level of trust in influencers communicating about green energy in Poland, where the participants mentioned the important role of energy experts, relatives, or friends in making decisions regarding renewable energies (Zatwarnicka-Madura et al., 2022). Although we did not measure the level of trust in environmental OLs and OLOs by their audiences, we saw a tendency to ask these influential individuals and organizations which energy provider is better or which energy source is less polluting. These questions somehow illustrate a certain level of trust in environmental OLs and OLOs in our target countries. Since “individuals may learn to trust certain media outlets through opinion leaders” (Turcotte et al., 2015, p. 531), we suggest that collaborations between media and environmental OLs can bring fruitful results in communicating about the food, energy, and transport solutions to CC mitigation.

Interestingly, the comments to the posts by organizations included less personalized opinions and, in some cases, criticized the posts by the OLOs, which may be linked to the increasing academics’ and activists’ criticism of environmental movements and organizations (Berny & Rootes, 2018). Several studies emphasized the role of collaboration between different NGOs and companies to improve their environmental performance (Albino et al., 2012; Peloza & Falkenberg, 2009). Other studies discussed the significant results from collaboration between companies and greenfluencers or environmental OLs (Sailer et al., 2022). To our knowledge, no study exists on collaboration between environmental OLs and OLOs. We may suppose that the collaboration between individual and organizational environmental OLs can bring potential results in raising awareness about CC issues, improving trustworthiness in organizations, and motivating climate action.

The obstacles appeared in several iconic signs of the visual mode: pictures of meat, fossil fuel emissions, and fossil fuel pipes. The images of business owners and politicians as visual representations of obstacles are common in the four case studies. According to Wang et al. (2018), governmental organizations (NGOs) such as Greenpeace made some efforts to develop visual icons for the climate. The visuals by Greenpeace in our data included various

visual metaphors, iconic elements, and dramatic imagery. Such dramatic imagery can be compelling to understand the message and reach more people (Harvard & Hyvönen, 2023)

Regarding the plastic signs, the environmental OLs and OLOs used a wide range of colors, which is a specific characteristic of Instagram (Pearce et al., 2020). Besides, red and black colors within plastic signs were associated with the obstacles in all analyzed data. In scientific environmental communication, the red color can be associated with temperature increases, risks, and other anomalies (Schneider & Nocke, 2018). More generally, this color is associated with danger, caution, intensity, deviation from norms, powerlessness, and fear (Schneider, 2015). Although a recent study based on a computational approach to Instagram visuals associated high numbers of comments to the Instagram posts about CC containing red and orange colors (Qian et al., 2024), our data did not correspond to these results. The black color can be negatively associated with death (Chen, Kim, et al., 2022) or risks, contributing to the ambiguity of the visual message about CC (Foss & Burgess, 2023). Besides, dark images may generate a feeling of fear in their audiences and, therefore, be ineffective in communication (O'Neill & Nicholson-Cole, 2009). In this context, we suppose that using red and black colors may not be efficient in discussing solutions to CC mitigation in the food, energy, and transport spheres.

In several images, the obstacles were represented in the form of popular memes – humorous visuals circulating online that have been transformed by many users (Shifman, 2013). Indeed, recent studies of environmental memes on social media demonstrated a trend toward more negative representation of characters, which can be associated with government and companies' actions (M. Jones et al., 2022). Nevertheless, such memes in environmental discourses represent “a powerful form of media communication” (A. S. Ross & Rivers, 2019, p. 992), which can contribute to engaging the digital publics (M. Jones et al., 2022; San Cornelio et al., 2024).

Although Instagram is centered on visual content (M. Schäfer & Xiaoyue, 2023), our study has demonstrated a significant role of verbal mode of communication on Instagram. The verbal mode was significant for all case studies to identify the obstacles and the values related to them, which confirmed our **Hypothesis 2:**

The obstacles will be more clearly stated in the verbal mode of the posts, i.e., captions or text-on-image elements, on Instagram.

Contrary to the widespread opinion that people prefer posting short comments on Instagram (Manikonda et al., 2014), our data revealed a large number of long and sophisticated comments, where people expressed and argued their opinions about the proposed solutions or obstacles to CC mitigation.

In the verbal mode, the obstacles appeared in the posts' texts, text on-image elements, and comments with specific keywords or markers of obstacle discourse. In English, these markers include such words as *but*, *still*, and *just*. In French, these markers can be illustrated by such patterns as *certes ... mais, c'est ... mais, mais, problème, juste, même, même pas, quand même, malheureusement*. The markers *problème* or *malheureusement* already have a negative connotation and may be seen as direct markers of obstacle discourse. Words like *mais, juste, même, même pas*, and *quand même* were mainly used to emphasize the meaning of obstacles in an argument that followed these markers. As in the studies by our Norwegian colleagues, the marker *but* or *mais* served to indicate polyphony with different points of view, where the last argument is considered the most important and is linked to the obstacle (Fløttum et al., 2019; Fløttum, Gjerstad, & Oloko, 2021).

Instagram as a social media platform can be seen as a place where images and values influence each other (Abidin, 2016; S. Ross, 2019), yet the meanings of images can be ambiguous due to the complex visualization of different concepts (Trillò et al., 2021). The obstacles and the values to them were more frequently illustrated in verbal mode in the case studies, which may be a fundamental problem in values identification. Without a post's text, it is impossible to identify the value behind the obstacle. Such difficulty may directly influence the ambiguity of values within the image. This ambiguity is directly related to the intrinsic polysemy of images and their anchoring and relaying functions proposed by Barthes (Barthes, 1977). The relaying function here refers to a link between the images created by the verbal text (Joly & Martin, 2021), which was frequent in our case studies.

In the majority of the analyzed posts and comments, the obstacles to pro-environmental actions were linked to egoistic and hedonic values, as stated in several studies on environmental psychology (Bouman et al., 2018; Bouman, Steg, et al., 2021; Bouman, Van der Werff, et al., 2021), which confirmed our **Hypothesis 1**:

The obstacles to pro-environmental behavior in both posts and comments to them will be predominantly referred to the egoistic or hedonic values.

However, in the energy sector, we observed a tendency to attribute biospheric values to the obstacles. Although not numerous, it provided an interesting insight into audiences' opinions about the proposed solutions and desire to care for nature and the environment. Specifically, audiences' comments highlighted the negative environmental impacts of producing and installing windmills and solar panels, which demotivate them to use these renewable energies. Such individuals' views of renewable energies represent a second significant barrier to the sustainability transition in the energy sector after technology-related barriers (Sturm, 2020).

We illustrated a generalized representation of the obstacles and values concerning them that appeared in the posts and the comments in Figure 166. In this figure, the red-colored obstacle texts are linked to egoistic values, orange-colored texts – to hedonic values, green – to biospheric values, and white and black-colored obstacles are not attributed to any value category. As shown in Figure 166, the obstacles are divided into two major categories: individual and societal, where organizing the action and communication and knowledge obstacle categories can be linked to both levels of obstacles.

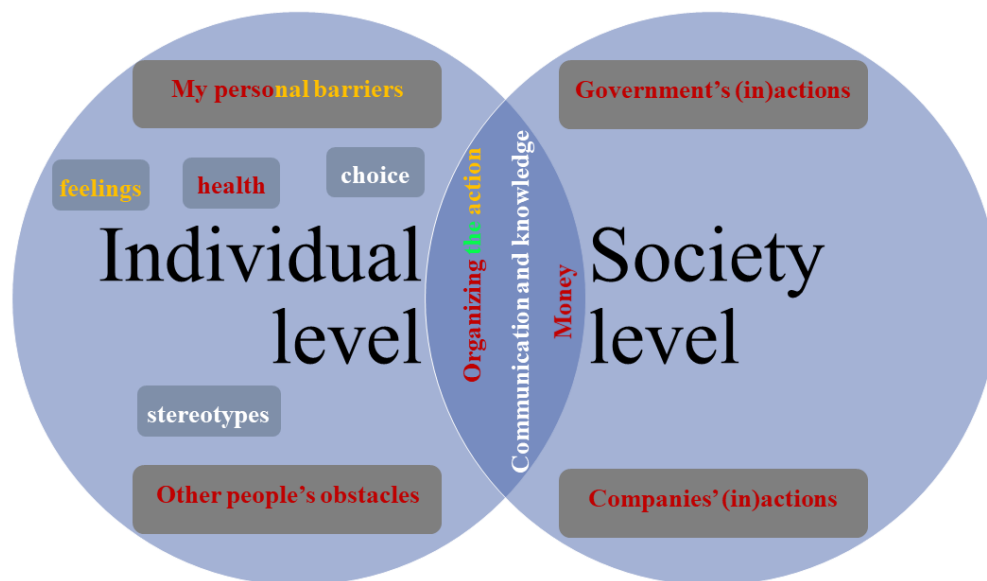


Figure 166 Obstacles and values in Instagram posts and comments

The obstacles on the individual level are also divided into two groups, such as barriers of an individual and obstacles related to other people. Feelings, health, and choice-related obstacles were mainly linked to the individuals' personal barriers, stereotypes-related obstacles were

more frequently discussed in relation to other people's barriers, and money-related obstacles can be attributed to both individual's barriers and other people's barriers. Money and health-related obstacles were directly linked to egoistic values, while personal feelings to hedonic values.

On the right part of Figure 166, we illustrate significant societal barriers, such as inactions by governments and companies, which are sometimes linked to financing problems. Society-level obstacles were predominantly linked to egoistic values. Organizing the action represented a large obstacle category, which may be linked to personal comfort (hedonic value), social power (egoistic value), or care for nature (biospheric value).

Overall, this scheme represents a complex relationship between all identified obstacles in the posts and the comments and their relationship with the values. The intersection of different values within one obstacle category indicates an ambivalent notion of values and the possible difficulty of their identification. Indeed, the values in relation to obstacles were mainly identified in the verbal component of multimodal communication about CC on Instagram. Without text, it would be impossible to decipher the meaning of values behind the obstacles in the analyzed posts. This leads us to the significant role of text in the representation and identification of the obstacle-related values on Instagram.

Regarding the biospheric value in relation to organizing the action obstacle category, the audiences frequently discussed in the comments the negative impacts of windmills, such as noise pollution and bird collisions. Noise pollution can be linked to hedonic values, while bird collision represents biospheric value. Nevertheless, the solutions to birds' collision avoidance are constantly developing (Ballester et al., 2024; Marques et al., 2014) but are not well communicated. The communication about these solutions is controversial or exaggerated. We found two of the most recent media articles about bird collisions in wind turbines by *Reporterre*⁶⁹ and *Le Monde*,⁷⁰ which are rather problem-oriented than solution-focused. They do not discuss concrete measures and technological advances limiting the collisions and, therefore, may be seen by specific audiences as alarming and even contribute to the rejection

⁶⁹ <https://reporterre.net/Eoliennes-Comment-eviter-la-mort-des-oiseaux>

⁷⁰ https://www.lemonde.fr/les-decodeurs/article/2022/03/28/les-eoliennes-sont-elles-un-danger-pour-les-oiseaux_6119502_4355770.html

of wind energy sources. Therefore, media, environmental OLs, and OLOs need to collaborate with scientists on recent technological advances to produce more effective communication about the existing solutions.

The identified narrative roles in the posts and the comments in all case studies represented mainly individual actors, group entities, specific industries for each sector, and nature and environment. Overall, the discourses around these narrative roles considered heroic, vulnerable, and inheriting storylines, as in the work by Jones, Davison, and Lucas (2023). The heroic storylines represented heroes as the main characters of the posts, frequently accompanied by ethical images. Vulnerable storylines depicted the victims of CC impacts: the posts discussed the influence of CC on nature or future generations. Inheriting storyline was characteristic of organizational discourses about chaotic futures inherited from the actions of governments and industries.

The villain role was particularly developed in analyzed posts and comments. Indeed, it can correlate with the attribution of responsibility and blame framing discussed in previous studies on climate journalism and climate activism (Engesser & Brüggemann, 2015; Molder et al., 2021). The politicians and industries were mainly seen as past and current villains–potential future heroes (Gjerstad & Fløttum, 2021) in both comments and posts. A linguistic study on sustainability reports by global fossil fuel companies demonstrated that they acknowledged their role as villains, which was softened by their representation of themselves as noticeable heroes (Dahl, 2022). In addition, as in the study by Gjerstad and Fløttum (2021), all people or “us” as humanity were mainly seen as potential future heroes (actors who are supposed to act for the climate in the future) and past and current villains–potential future heroes (actors who were villains in the past but can become heroes in future).

In all case studies, nature, environment, animals, and plants were represented as primary victims, as in the study by Bevan, Colley, and Workman (Bevan et al., 2020).

In all case studies, the narrative roles were widely represented by different actors, yet the most extensive list appeared in the French energy-related data. Although the posts discussed fossil fuels and renewable energies, the comments to these posts frequently evoked nuclear energies as well. In the comments, the audiences expressed various opinions on who is responsible for inaction and who should contribute to CC mitigation. The comments data illustrated different narrative universes, which may contribute to the global understanding of the inaction problem.

To summarize, the case studies provided a multifaceted overview of the representation of the obstacles, values, and narrative roles in the Instagram posts. The case studies are united by the similarities of the obstacles, the values related to them, and the narrative roles. Nevertheless, several distinctive features were identified in the energy sector, where discussions on fossil fuels, renewable energies, and nuclear energies were more polarized than on adopting vegetarian diets, public transport, or electric vehicle use. The audiences' trust in environmental OLs' opinions can be an entry point to collaborating with these influential individuals to motivate people to adopt environmentally friendly actions. On the one hand, our study confirmed the descriptions of Instagram visual vernaculars communicating about CC as experience-based (Pearce et al., 2020) since most of the analyzed posts by OLs demonstrated personal experiences. On the other hand, contrary to the suggestions of Pearce et al. (2020), the OLs and OLOs' communication was informational: the posts contained specific information about different actions, actors, campaigns, protests, obstacles, and tips to overcome them.

Chapter 7: Key elements

- In the proposed case studies, the obstacles appeared in several iconic signs of the visual mode: pictures of meat, fossil fuel emissions, and fossil fuel pipes.
- The governments' (in) actions as an obstacle were represented in iconic signs by portraits of politicians, who also took the role of villains and sometimes potential future heroes in the posts in all case studies.
- Biospheric values in the iconic signs were represented by images of nature, trees, and emissions from fossil fuels.
- Altruistic values in the iconic signs included the images of people participating in protesting and other collective actions.
- Egoistic values in the iconic signs were illustrated with images of money and men wearing costumes.
- Hedonic values were predominant in the food-related subcorpus in France and were represented by food images.
- In all case studies, the obstacles were predominantly linked to red, orange, and black colors in the plastic signs of the visuals.
- All obstacles can be divided into two large groups: obstacles on the individual and societal levels.

- The obstacles on the individual level include personal feelings, health, choice, and stereotypes.
- The obstacles on the societal level incorporate governments' and companies' (in)actions.
- Communication and knowledge, money, and organizing the action are transversal obstacles.
- All case studies demonstrated a significant role of verbal mode in communicating about CC-related issues on Instagram.
- The linguistic markers of obstacle discourse in English are such words as *but*, *still*, and *just*.
- In French, the markers of obstacle discourse include *certes ... mais*, *c'est ... mais*, *mais*, *problème*, *juste*, *même*, *même pas*, *quand même*, *malheureusement*.
- In Belgium and France, the adjective “renewable” had a positive connotation in the posts and a negative connotation in the comments. The audiences demonstrated a high level of criticism towards renewable energies in the comments, in particular, due to their harmful effects on nature and the environment and the impacts on poorer nations extracting minerals for solar panel batteries.
- Most obstacles in the case studies were linked to egoistic and hedonic values, except in the energy sector, where we observed a tendency to attribute biospheric values to the obstacles.
- The sentiment analysis of the comments demonstrated that the majority of the obstacles were linked to the comments labeled as “negative” or “mostly negative.” However, the sentiment analysis model demands further fine-tuning based on climate-related data.
- The identified narrative roles in the posts and the comments in all case studies represented mainly individual actors, group entities, specific industries for each sector, and nature and environment.

Chapter 8 Conclusion

This chapter summarizes the present doctoral thesis, discusses the study's limitations and future perspectives, and concludes with practical, methodological, and pedagogical implications.

8.1 Summary of the study

The main objectives of this work were to systematize environmental communication on Instagram and build bridges between the analyzed data and practical recommendations for communication practitioners. We overviewed and mapped the recent environmental multimodal communication on Instagram in three countries: Belgium, France, and Norway. We focused on the visuals and texts posted by the environmental OLs and OLOs about the sustainability transition in the food, energy, and transport sectors to distinguish the obstacles to pro-environmental actions. Besides, we investigated the audiences' comments to specific posts to understand audiences' opinions on the obstacles. Since the value-based approach to environmental communication remains widely understudied (Fage-Butler, 2022), we linked the advances of environmental psychology to communication research in this study. More precisely, we identified the value clusters and their relations to the obstacles mentioned in the posts and the comments. As a result, this study fills the research gaps on obstacles to pro-environmental action since the previous studies were generally based on survey data.

The present research was designed to work on two main research questions and two contributory research questions, and it tested three hypotheses. We focused on 120 accounts of environmental OLs and OLOs since their communication can motivate their audience to contribute to CC mitigation. The environmental OLs and OLOs were manually selected using five criteria: enduring involvement and information sharing, interpersonal influence, expertise, intermediality, and interconnectedness. With the help of computational tools, we collected a large corpus of posts by environmental OLs and OLOs (N=22882 posts). To make the corpus homogenous, we selected only the posts available for each account for a specific period: January 2021–March 2022 (N=10123). We called this data *Corpus21-22*. In addition, we collected 22608 comments to these posts. Overall, this study incorporated two parts: a multimodal content analysis study of *Corpus21-22* and mixed-method case studies incorporating different automatic and manual analyses.

The first research question⁷¹ aimed to identify the tendencies in Instagram posts by environmental OLs and OLOs concerning climate actions, actors, obstacles, and values in the three sectors. These tendencies were investigated during a multimodal content analysis of *Corpus21-22* and mixed-method case studies.

We applied an automated content analysis based on dictionaries to identify posts about the food, energy, and transport sectors. This procedure allowed us to select a subcorpus of 2092 posts (*Corpus21-22_FET*) for further analysis. The large sample size of the *Corpus21-22_FET* is a specific characteristic of this research compared to other studies applying multimodal content analysis on “modest sample sizes from one to 200” (M. Schäfer & Xiaoyue, 2023, p. 70).

Before conducting multimodal content analysis, we quantitatively analyzed the metadata of *Corpus21-22*, focusing on likes, comments, mentions, hashtags, and post dates. We concluded that most posted content centered around environmental or political events, such as COP meetings, climate marches, releases of the IPCC reports, or adoption of specific sustainable policies. Besides, using hashtags in the posts and posting video content positively influenced the engagement rates of the posts in this corpus.

The *Corpus21-22_FET* was analyzed through the prism of multimodal content analysis based on four categories of questions: CC and environment, actions and actors, obstacles, and values (cf. Appendix 4 *Multimodal content analysis codebook*). To validate the proposed multimodal content analysis method, we effectuated a case study based on the Instagram data by the Youth for Climate movement on Instagram. During this preliminary investigation, we adapted our codebook questions and categories and formulated three hypotheses. These hypotheses referred to the representation of obstacles and their values.

The results from multimodal content analysis demonstrated a variety of themes discussed in the posts by environmental OLs and OLOs, which were solution-oriented. The most frequently discussed subjects reflected the food sector, especially reducing meat consumption. In the energy sector, multiple controversial opinions appeared in the comments

⁷¹ What are the semiotic forms of individual and organizational discourses on climate change efforts in food, transport, and energy sectors communicated in the posts of Belgian, French, and Norwegian opinion leaders on Instagram between 2021–2022?

to the analyzed case studies addressing the negative impacts of producing and installing windmills and solar panels. The transport sector was the least discussed theme in *Corpus21-22_FET*. The posts by environmental OLs and OLOs communicated about various individual and collective actors contributing or not to CC mitigation. Although not as numerous as expected, the obstacles appeared in about 10–20% of the analyzed posts. On the individual level, obstacles included lack of money, the influence of personal habits or feelings, and stereotyping opinions. On the collective level, the obstacles were linked to the actions of governments and companies. Communication and knowledge, and organizing the action were transversal categories linking obstacles on individual and societal levels. In their posts, the environmental OLs and OLOs used multiple environmental values with particular emphasis on biospheric values. The evidence from the multimodal content analysis of the *Corpus21-22_FET* has confirmed our Hypotheses 1 and 2. Egoistic and hedonic values appeared more frequently to the observed obstacles to CC mitigation. Although they were sometimes visualized in the images and videos, the obstacles and the values were predominantly expressed and detailed in the verbal mode, i.e., the text within the images and videos and the posts' texts.

To understand the semiotic forms, specific patterns, and trends in environmental communication about the sustainability transition in the food, energy, and transport sectors, we conducted four mixed-method case studies. We selected the subcorpora for each case study according to the findings from the multimodal content analysis. Specifically, we chose the themes with the highest number of obstacles appearing in the posts. These themes included reducing meat consumption in France, using public transport and electric vehicles in France, and transitioning from fossil fuels to renewable energies in Belgium and France. The Norwegian subcorpus in the case studies was underrepresented, which indicates a limitation of this research.

Each case study comprised a two-step analysis: an analysis of the posts and an analysis of the comments. The posts were analyzed with the help of multimodal discourse analysis adapted to our research questions. Multimodal discourse analysis included qualitative observations of iconic, plastic, and linguistic signs. To complement our qualitative observations of the posts and visualize specific linguistic patterns in the posts' texts, we used *Sketch Engine*.

As for the second research question⁷², we studied the audiences' perceptions via comment data to better contextualize the audience's opinions about the obstacles in the food, energy, and transport sectors. A content analysis addressed the comments to identify the obstacles, the values behind them, and narrative roles. We used sentiment analysis and computer-assisted linguistic analysis with *Sketch Engine* to complement the results of the content analysis of the comments. The sentiment analysis results crossed with the comments' content analysis only partially confirmed our Hypothesis 3. The obstacles appeared mainly in the negatively labeled comments, yet they were also present to a small extent in the positively labeled comments. However, it contributed to the extension of the sentiment analysis method beyond the Twitter/X platform, which represents the majority of the data used for this method (Lheureux, 2023).

A case study investigation of selected themes provided specific visual and linguistic patterns. In the visual mode, illustrations and textual knowledge images were significant in the analyzed data. The iconic obstacle representations included images of meat, fossil fuel emissions, or portraits of politicians. In plastic signs, the obstacles were mainly represented by red and black colors. Linguistic markers of obstacles typically included such words as *mais*, and *certes ... mais*. The posts illustrating personal experiences in all case studies obtained the highest engagement rates. The role of text was significant in identifying the obstacles and values in the posts. In the case studies, the most frequently discussed obstacles correlated with obstacles identified during multimodal content analysis and confirmed our Hypotheses 1–2. The obstacles to pro-environmental behavior in both posts and comments predominantly referred to egoistic or hedonic values. Besides, the obstacles were more clearly stated in the verbal mode of the posts, i.e., captions or text-on-image elements, on Instagram.

In the comments, audiences provided a vast range of obstacles on individual and collective levels, allowing us to construct a scheme reflecting obstacles and related values (cf. Figure 166). Globally speaking, the complex approach of the case studies augmented our multimodal discourse analysis and contributed to the research questions.

⁷² How are these messages perceived by the audiences in terms of obstacles to pro-environmental action and environmental values?

In the last four years, environmental communication research has been criticized for focusing too narrowly on framing theory (Agin & Karlsson, 2021). Some authors identified the potential of combining different qualitative, quantitative, and computational approaches “in a complementary fashion” (M. Schäfer & Hase, 2022, p. 6). We argue that the present study offered a novel perspective on multimodal environmental communication on Instagram by combining different methods to provide robust results.

In addition, our research can be seen as an extension of the study by Schmid-Petry and Zehe (2024), who conducted a quantitative content analysis of Instagram posts in German and English about energy transition at the beginning of January 2022. More precisely, we go beyond one-theme research on environmental communication and address the posts related to food, energy, and transport themes. Moreover, we contextualize the results obtained by comparing and contrasting the situation in these spheres in Belgium, France, and Norway.

Furthermore, this study is probably the most extensive study of semi-automated content analysis of social media posts today. The multimodal content analysis of *Corpus21-22_FET* identified the actions, actors, obstacles, and values, which provided a deeper understanding of environmental discourses on social media posts. The case studies allowed us to identify the trending visual and linguistic patterns representing the obstacles to pro-environmental behavior. We believe that communication practitioners and researchers can apply the results of this study.

To conclude, we argue that Instagram plays an essential role in informing young audiences about CC and environment-related issues: the environmental OLs and OLOs communicate about climate causes, impacts, and actions, highlighting different actors that should contribute to CC mitigation. Adapting communication strategies to the platform affordances and general trends can provide meaningful results.

8.2 Limitations and future perspectives

In this part, we delineate the limitations of the conducted research and discuss the potential for future research work. We start with the commentary on the limitations of corpus selection and data collection from Instagram. Then, we present the limitations of data analysis. We complete this section by suggesting future perspectives.

8.2.1 Limitations of corpora selection and data collection

For this study, we adopted a manual selection of environmental OLs and OLOs. We manually selected accounts of individuals discussing CC and environment-related topics from the followers of environmental NGOs and movements, such as Greenpeace, WWF, or Youth for Climate. This manual selection was conducted in 2021. Since Instagram is a constantly changing platform, we suppose that, with changed algorithms or a significant rise of accounts' followers, this manual approach to identifying environmental OLs and OLOs would provide different results today. It does not necessarily mean that the selected accounts cannot be considered environmental OLs and OLOs today. Instead, it reflects the diversity of the accounts and data published on Instagram, which may influence data selection at specific temporal points.

Furthermore, we observed that several accounts of environmental OLs changed their profiles to private profiles over time, restricting access to their data. These accounts were mainly the accounts of micro-influencers with less than 5k followers. In this case, the preliminary collection of visuals and posts' captions allowed us full access to the data posted by these individuals. However, calling such individual accounts environmental OLs can be controversial since we do not know whether they continue posting about environment-related issues.

In addition, our subcorpus of Norwegian data was smaller compared to the French and Belgian subcorpora. First, this is due to the lack of contextualized knowledge about the Norwegian opinion-leading discourses about CC and the environment. Second, it can be linked to a relatively small number of followers of environmental NGOs used to select the accounts of opinion leaders.

Instagram content is dynamic and unpredictable: Over 95 million photos and videos are posted every day in the world (Lister, 2024). Considering such constantly evolving content, ensuring consistency in data collection over time may be challenging.

Regarding the data collection, we used a Vurku Pro plan to collect the 500 most recent posts from an account (cf. Section 4.2.2.1 *Instagram posts: methods for retrieving the data*). Although the platform claimed the possible collection of 500 posts, in some cases, it did not fully collect the data. We suppose this limitation is directly linked to the Instagram platform, one of the most restrictive platforms for data collection (Pearce et al., 2020). In addition to this,

the Vurku tool disappeared in 2023. Thus, we cannot recommend this method of Instagram data collection to other scholars.

As Vurku, the comment collecting code provided by Bencode (cf. Section 4.2.2.1 *Instagram posts: methods for retrieving the data*) was not perfect for obtaining all comments under the selected posts. We observed that not all comments to the posts were collected, which may be linked to Instagram restrictions or the tool's limitations. Unfortunately, we do not know the criteria for collecting comments. However, we observed that the tool collected all comments if they were not numerous under a post. If a post contained several hundreds of comments, we estimated that about 80% of the comments were collected, which is still a robust result.

Overall, Instagram data collection is a complex and complicated procedure that has not improved. To our knowledge, other tools for Instagram data collection also faced different restrictions. For example, *Crowdtangle*, a *Meta*-provided tool for researchers, will not be available from 14 August 2024. Today, *Meta* has been developing its Content Library, which can be available to researchers if the platform accepts their application. This lengthy procedure may complicate the already complicated data collection process from Instagram for research purposes. In addition, the *Post.py* Python code does not function anymore, probably due to the constant modifications of Instagram.

To summarize, data collection from Instagram is a complicated process limited by the Instagram API restrictions, dynamics of the content itself, and difficulties in automated data collection via paid services and open-source tools. However, this social media represents a high potential for visual studies and is seen by many researchers as a prominent tool for environmental communication (Pearce et al., 2020; San Cornelio et al., 2024; Schmid-Petri & Zehe, 2024).

8.2.2 Limitations of data analyses and future perspectives

Our research focused on integrating visuals, captions, and comments to understand the emerging trends in multimodal discourses about CC solutions, obstacles, and environmental values. Although it provided different variations of opinions in the three countries, it had several limitations, which we discuss in this part. First, we delineate general limitations related to the data analyses. Then, we highlight the limitations of automated content analysis, multimodal content analysis, and mixed-method approach. We propose different suggestions for each limitation that could be used in future studies.

The present work represents a generalized view of environmental communication on Instagram by environmental OLs and OLOs in the three countries. The focus of this study was content, not the enunciators' profiles. In particular, we studied the combination of visuals and captions posted on Instagram alongside the comments on these posts. When providing the results, we distinguished the differences in communication by different types of individual and organizational accounts in some cases, although it was not an objective of this study. The initial purpose of this study was to map the emerging multimodal discourses and specific trends concerning solutions, actors, obstacles, and values present in Instagram posts. Therefore, this study did not consider several aspects that may seem significant, such as corporate social responsibility, self-representation, monetization factors, or demographic data.

In their communication, environmental NGOs could have applied different techniques related to their corporate social responsibility, i.e., ethical and discretionary aspects linked to sustainable development and used by organizations (Carroll, 2015). This influence of organizations' corporate social responsibility on their Instagram communication was not considered in this study. Nevertheless, it can be a focus of future investigations.

Furthermore, we did not distinguish between micro-, meso-, and macro-influencing accounts of environmental OLs and OLOs as it is frequently done in marketing studies. Future studies could consider such account types since the account size can impact an influencer's credibility and, therefore, their audiences' pro-environmental intentions (De Veirman et al., 2017). In addition, an interview-based study of environmental OLs and OLOs about their view of environmental communication on Instagram would be a valuable contribution to our research.

In several analyzed posts, we observed sponsored content promoted by environmental OLs. During the data analysis, we did not consider such monetization factors since they were not the aim of our study. However, future studies may specifically focus on sponsored content to understand how the collaboration between companies, institutions, NGOs, and environmental OLs functions.

Demographic data is frequently used in social sciences to investigate the environment-related issues. Since our study focused on the Instagram platform, which does not systematically provide socio-demographic information, it was complicated to distinguish between socio-demographic variables. Moreover, this distinction between ages, genders, professions, or other sociological variables was not the aim of this study. Nevertheless, we

suggest conducting online ethnographic methods to overcome this limitation for future research.

Although the present study was not explicitly focused on identifying CC metaphors, we observed several trending color- or war-related metaphors, such as *green claims*, *combattre la crise climatique*, or *batailles à mener*. Scholars have already studied climate metaphors in communication and linguistic studies (Augé, 2021a, 2022; Deignan et al., 2019; Flusberg et al., 2017; Nerlich, 2011). Following these studies, we believe climate metaphors represent a prominent research field and can be further examined with a qualitative investigation.

The automated content analysis with *MaxQDA* provided us with a potent corpus of data focused on the target themes. Nevertheless, using specific keywords to filter data might have excluded relevant posts that use different terminology. In addition, the *MaxQDA* tool does not filter visual data based on keywords. In this case, it will not be effective when the key message is transmitted in the visual mode. However, we still see a high potential in using this method to filter text-based messages from X, Facebook, or other platforms, where text plays an important role. This usage may significantly contribute to evaluating the method's validity and further potential improvements, which are important for developing automated content analysis as a research method (Hase, 2023).

Another computational method used for this study was sentiment analysis, which demonstrated interesting but still low results in identifying comments containing obstacles. Indeed, sentiment analysis may not always accurately capture the nuances of human emotion and sentiment, especially in sarcasm or irony (Dahal et al., 2019). In our work, we identified positivity or negativity within the comments. Recent studies on sentiments regarding climate action demonstrated that different emotions of fear, hope, anger, or guilt influence individuals' pro-environmental efforts. For example, feelings of hope can be related to proactive policy support, or feelings of fear are related to the support of regulatory policies (Myers et al., 2024). It would be interesting to extend our sentiment analysis to more specific examples to verify whether the results would correspond to the ones obtained by Myers et al. (2024).

In this research, we conducted quantitative linguistic observations with *Sketch Engine* only on the texts of the posts and the comments. However, about 90% of the visuals in *Corpus21-22_FET* contained text-on-image elements. Analyzing the texts from images and videos could influence the results obtained with the *Sketch Engine*. For future studies,

incorporating computational approaches to text identification from the image and its further analysis in *Sketch Engine* could significantly contribute to our research.

In addition to the computational limitations discussed above, the study did not account for the influence of bots or coordinated disinformation campaigns on the environmental discourse on Instagram. Further collaboration with computational scholars could help overcome this limitation.

In the present study, we used a simplified narrative analysis scheme and investigated the roles of heroes, villains, and victims in the posts and comments. Since storytelling is an essential part of current Instagram communication (Kozharinova & Manovich, 2024), we suggest that future studies investigate the storylines behind environmental communication on this social media.

Another limitation of this study is directly related to a certain level of subjectivity during multimodal content analysis and multimodal discourse analysis of the posts, and content analysis of the comments. Overall, analyzing environmental values and obstacles to efforts on CC mitigation required a deep understanding of specific contexts and largely depended on the researcher's interpretation of the posts. However, to limit this subjectivity bias, the researcher consulted additional information about specific contexts in media articles and discussions with colleagues from Belgium and France.

In addition to a certain level of subjectivity of data analysis, unfortunately, we could not select a robust subcorpus of Norwegian Instagram posts for mixed-method studies since we did not observe a significant number of obstacles in these posts. It may also be related to fewer collected posts for the Norwegian subcorpus. This limitation should be treated in further research.

This study analyzed the audiences' perceptions of environmental discourses through the comment data. Future studies may apply surveys, interviews, or eye-tracking methods to evaluate people's perceptions of the text-on-image elements or red and black colors within visuals as a part of multimodal environmental communication. It is particularly interesting to study French, Belgian, and Norwegian audiences' perceptions of obstacles to pro-environmental actions discussed in multimodal communication on social media since most studies on audience perceptions of CC visuals were based on American data (Ettinger et al., 2021).

Finally, this study addressed the data from one social media platform – Instagram. As the uses of social media platforms are not interchangeable and the results from the one-platform study are not interchangeable (Hopke, 2024), we suggest future research to investigate the obstacles to CC mitigation and the values concerning these obstacles on other social media platforms. We suppose that the analysis of the TikTok or YouTube data would provide different yet complementary results to this study.

To recapitulate, the limitations of this study are linked to the choice of selected research methods, which were more content-oriented than personality-oriented. We also highlighted the importance of further developing computational methods, narrative analysis, and audience perception studies to comprehensively understand environmental communication on social media. While discussing these limitations, we suggested multiple paths for further research to deepen our understanding of online environmental discourse and its impact on pro-environmental behavior, such as expanding the scope to other social media platforms like TikTok and YouTube or applying different qualitative ethnographic or sociological approaches to complement our findings.

8.3 Implications

The present study can be seen as an example of a complex mixed-method research aimed at mapping environmental discourses across countries. In this part, we will try to answer the initial questions for any research: What does this study serve for? How can we use the obtained results? First of all, the results of this study can be interesting for environmental communication practitioners, who need to communicate about such a complex issue as CC and its mitigation. We summarize several recommendations for practitioners in Section 8.3.1 *Implications for communication practitioners*. Second, this study can be seen as an attempt to combine different classical methods in communication research with more novel approaches, which can be replicated or adapted by other scholars and are discussed in Section 8.3.2 *Methodological implications in environmental communication research: A multimodal approach*. Finally, we used the collected corpora to teach environmental communication and discuss this and other potential pedagogical implications in Section 8.3.3 *Pedagogical implications*.

8.3.1 Implications for communication practitioners

This part applies our findings to provide practical recommendations that individual and organizational environmental OLs and other practitioners may use. We first discuss several recommendations concerning the food, transport, and energy themes. Then, we propose recommendations according to the content type. We conclude this part with suggestions on possible collaborations.

Since regular information consumption via social media and observation of influential individuals can be associated with pursuing vegetarian diets (Kley et al., 2023), we suggest environmental OLs and OLOs to improve communication about vegetarian lifestyles. We recommend that communicators discuss concrete practices to overcome the significant barriers discussed in the comments: health, choice, and organizing the action. For example, we propose to discuss the **benefits of vegetarian diets on people's health** in social media, **highlighting the care for nature and the environment** since it may increase peoples' motivations to act (Bouman, Steg, et al., 2021). The most engaging and motivational content about reducing meat consumption in our data included the discussions of **personal experiences and recommendations**; thus, specific audiences may see such experiences in social media communication as a motivational factor. Following the recommendations of de Boer and Aiking (2017), we suggest that framing personal experiences and solutions should be **internally consistent, culturally relevant, and feasible or concrete** in the perceptions of the audiences.

In the transport and energy sectors, multiple controversies appeared in relation to electric vehicle use, renewable energies, fossil fuel taxonomy, and nuclear energies. The communicators might focus on the controversies that appear in the comments and provide concrete information about **existing and new technologies**. To avoid further criticism of the posted content, this information should be **supported by scientific sources**. Highlighting biospheric values in communication about solutions in the energy sector seems to be a significant factor since this value is frequently associated with obstacles. Specifically, the social media posts can focus on the existing solutions used in the renewable energy industry to mitigate nature pollution and improve nature protection factors, such as technological improvements to avoid bird collisions.

The audience's engagement with social media posts can depend on the type of content posted. As in the study by Perea, Bonsón, and Bednárová (2021), our findings demonstrated that still images on Instagram achieved a higher number of likes while video posts positively

influenced the number of comments to them. Thus, **to understand users' opinions on CC-related subjects**, such as solutions or obstacles, **and to increase users' involvement in comments, we recommend posting video content about the topic of interest**. Video content is essential since videos can positively influence awareness and concern about CC issues (Ballantyne et al., 2016).

A study by Habibi and Salim (2021) evaluated the user's engagement concerning different types of videos on TikTok, which are similar to Instagram Reels format. Indeed, 15-second videos are usually entirely watched by the audience. However, to stimulate discussion in the comments, the videos should last 40–60 seconds (Habibi & Salim, 2021). In line with this research and our findings, we suggest that the communicators of CC issues adopt **short video content** in their works. This **content needs to be clear, objective, creative, dynamic, and informative** (Ferreira et al., 2023). However, the dynamic of the content does not concern scientific graphs since it may negatively influence the credibility of the information by older audiences (N. Li et al., 2018). Besides, educational videos of different formats about CC and environment-related themes are needed on social media platforms (Duran-Becerra et al., 2020).

Regarding the visuals, we recommend avoiding red, black, and too-dark colors since they may be associated with obstacles. In addition, too dark colors in graphs may produce controversial effects on the audiences (Schneider & Nocke, 2018). **High-quality, colorful images** can increase the engagement rates of Instagram posts (Y. Li & Xie, 2020).

As a popular content in environmental communication, memes may be a prominent communication element (San Cornelio et al., 2024). However, the meme structures should be carefully chosen to avoid shaming other peoples' inaction or mistakes and highlight the motivation to action.

A recent study by Opinion Way and ADEME (2023) has shown that organizations besides Greenpeace and WWF in France are less known by citizens. However, these organizations play a significant role in the local transition and may be considered potential partners in the sustainability transition. Recognizing these organizations and raising citizens' awareness about their actions may significantly bridge global and local action. Since individual environmental OLs were considered reference figures in numerous comments of this study, **identifying such influential individuals on local levels and collaborating with them can also provide important results**. Additionally, **communication practitioners should consider congruence** in their communication, i.e., a match between the image, behavior, and expertise,

which can contribute to the effective promotion of environmental behavior (Boerman et al., 2022). The message about concrete actions should reflect personal attitudes and beliefs or corporate social responsibility that are transmitted on social media by environmental OLs and OLOs.

To summarize, the multimodal communication about CC mitigation on social media should address concrete, argumentative solutions. The images should be of high quality, avoiding an increased representation of red and black colors. The content, except for scientific graphs, should be dynamic to improve audience engagement. Such dynamic content may involve short videos in Reels format. Memes can be an effective form of engaging the audiences. Finally, the collaboration between different organizations and environmental OLs can potentially provide fruitful results in raising awareness about CC solutions and motivating climate action.

8.3.2 Methodological implications in environmental communication research: A multimodal approach

In the constantly evolving landscape of communication research on social media data, researchers adopt innovative methodologies for analysis. This thesis is no exception: We explored a variety of methodological tools and approaches to examine multimodal communication about CC-related issues on Instagram. In the following paragraphs, we discuss the replicability of applied research methods and tools for other studies in communication and other social sciences.

For an automated content analysis, we used a dictionary approach to identify the posts about our focus themes: food, energy, and transport. These dictionaries were developed in four languages: English, French, Dutch, and Norwegian (cf. Appendix 2 *Multilingual dictionaries for automatic content analysis*). A similar dictionary method was used by Walter and Bruggeman (2018) to identify different groups of Twitter users in their dataset with the help of R packages. In our case, we coded the data with the help of the *MaxQDA* tool, which is a more user-friendly approach and can be replicated by the researchers without programming skills. Other researchers can use these dictionaries to identify similar themes across different datasets, contributing to the replicability of the analysis. Moreover, we suggest that the flexibility of these dictionaries allows them to be adapted for automated image analysis, presenting a novel approach to classifying visual content in social media.

We applied a multimodal content analysis to analyze a cross-country corpus of Instagram posts about CC and its mitigation, demonstrating significant potential for broader applications. The codebooks designed to analyze Instagram posts can be replicated and adapted to different datasets from other social media platforms. In addition, we see a high potential in adopting our Multimodal content analysis codebook (cf. Appendix 4 *Multimodal content analysis codebook*) to the studies of climate actions and actors, obstacles, and environmental values from other disciplines and other data. For example, a study of survey responses or interviews could benefit from our codebook to investigate obstacle-value relationships from the sociology or environmental psychology perspective.

We used multimodal discourse analysis to qualitatively analyze sub-sets of data and the representation of obstacles, values, and narrative roles. Although we simplified the analysis grid proposed by Joly and Martin (2021), this analysis provided robust results for Instagram data on environmental communication. Future studies may expand this approach to other social media platforms, such as TikTok or YouTube, by adding a more detailed analysis of the audio-visual mode or by expanding the signs to the analysis of emojis. We used the *ImageSorter* tool to complement multimodal discourse analysis, which demonstrated fast and prominent results in filtering images by colors and date. As Pearce et al. (2020), we recommend using this tool to complement visual data analysis in communication research.

As a multimodal content analysis codebook, the codebook developed for the comments' analysis (provided in Appendix 6 *Codebook for the content analysis of the comments*) can be a starting point or an initial analysis grid for other studies on obstacles to CC mitigation, environmental values, and narrative roles. Nevertheless, we suggest that future studies separate the questions regarding different modes of social media posts to provide better statistical results considering visual or verbal content.

Using sentiment analysis to identify the obstacles to CC mitigation in the comments has demonstrated its potential utility. However, this method demonstrated several limitations (cf. 8.2.2 *Limitations of data analyses*). The multilingual sentiment analysis model provided by Hugging Face revealed its capability to examine large datasets of comments. This approach could serve as a valuable starting point for identifying comments containing specific obstacles, providing a filtered subcorpus for subsequent qualitative analysis. Nevertheless, the sentiment analysis model could benefit from further fine-tuning to enhance its accuracy and relevance in environmental communication.

Sketch Engine, primarily used by linguists, has shown promise in communication research, particularly in visualizing linguistic patterns generated inductively during data analysis. This tool's ability to present patterns visually can help researchers identify trends and make connections within their data. The use of *Sketch Engine* in the context of our study has demonstrated the value of cross-disciplinary tools in communication research, encouraging further exploration of methodologies beyond their traditional uses.

The mixed-method research design offered a comprehensive approach to understanding the obstacles, values, and narrative roles in Instagram posts and comments from multiple perspectives. Although challenges remain, such as data integration and maintaining coherence across methods, the adaptability and depth provided by mixed-method designs make them suitable for investigating complex communication patterns. Thus, we suggest that the proposed mixed-method analysis of Instagram posts and comments to them can be used to the data from other social media, such as Facebook, TikTok, or YouTube.

The methodological implications outlined above reflect the dynamic and evolving nature of environmental communication research in digital environments (M. Schäfer & Hase, 2022). The flexibility and adaptability of used methods and tools, such as dictionaries, content analysis codebooks, sentiment analysis, mixed-method research design, *ImageSorter*, and *Sketch Engine*, contribute to a more robust understanding of environmental communication across social media platforms. By applying these methodologies, researchers can explore complex multimodal communication with greater accuracy and depth, ultimately advancing environmental communication research.

8.3.3 Pedagogical implications

Besides methodological and communicational implications, this research can be used for pedagogical purposes. We published the collected corpus of Instagram data on the university *Dataverse* under the following references:

- Samofalova, Yuliya; Catellani, Andrea; Pizarro Pedraza, Andrea; Cougnon, Louise-Amélie (2022), Instagram publications from Climate Change Opinion Leading Organizations in Belgium, France, and Norway, Dataset Publication, Open Data @ UCLouvain [online] <https://doi.org/10.14428/DVN/EIHK90> (3 November 2022).

– Samofalova, Yuliya; Catellani, Andrea; Pizarro Pedraza, Andrea; Cougnon, Louise-Amélie (2023), Instagram publications from 73 accounts of climate change opinion leaders in Belgium, France, and Norway, Dataset publication, Open Data @ UCLouvain [online] <https://doi.org/10.14428/DVN/K2QOVS> (1 February 2023).

For user convenience, we separated the two subcorpora of posts: the first subcorpus includes Instagram posts by environmental OLOs, and the second – pseudonymized Instagram posts by environmental OLs. University teachers may use these posts as examples of digital environmental communication or sustainability education. Indeed, some of the data from environmental organizations was already utilized by the students of a research-based class, CC-Insta, which was taught online in partnership with Humboldt University Berlin to Bachelor and Master Students of the Circle U Alliance in 2021-2022. This class aimed to develop students' competencies in communication research on social media data and to strengthen students' competence in visualizing quantitative and qualitative data. The results of this pedagogical approach were promising and were published in an academic article by Marcella and Samofalova (2022). In addition, as Reinhardt (2019), we see high potential in using this data for language classes to discuss environmentally-related themes on authentic data.

Appendices

Appendix 1 Instagram Timeline

6 October 2010	Instagram launched
8 December 2011	The 2011 th App Store iPhone App of the year
3 April 2012	Instagram for Android
9 April 2012	Facebook (now Meta) purchases Instagram
26 July 2012	80 million users
16 August 2012	Instagram Photo Maps launched
21 November 2012	Instagram Badges launched
10 December 2012	Photo Filters introduced
21 December 2012	25 languages introduced
5 February 2013	Instagram Feed introduced on the Web
26 February 2013	100 million monthly users
20 June 2013	Instagram adds video (15 seconds)
12 December 2013	Instagram Direct messaging service introduced
27 April 2015	New Photo Filters and Emoji Hashtags introduced
22 October 2015	Boomerang effect introduced
15 November 2015	5 % of Instagram posts are selfies
11 February 2016	View counts of Video introduced
15 March 2016	New policy of feed showing (you see first what is specially targeted for you)
21 June 2016	500 million users
18 October 2016	Instagram Stories introduced
21 December 2016	Save Posts and new Stickers introduced
24 January 2017	Live Stories launched
22 February 2017	10 Photos and Videos in one Post
22 March 2017	1 million advertisers
29 June 2017	New Policy of Self-Expression (it is a safe place)
23 January 2018	Animated Stickers (GIFs) introduced
21 March 2018	Hashtags and Links introduced in Bio

12 June 2018	Shopping function launched
20 June 2018	IGTV (Instagram TV) launched
28 June 2018	Music in Stories introduced
19 November 2018	Reducing inauthentic activity
4 June 2019	Branded content ads for Business accounts
5 August 2020	Reels launched
27 July 2021	Reels can be up to 60 seconds
2021	2 billion monthly active users
2022	Music available in posts
2023	Meta verified, a paid subscription for eligible profiles coming with benefits that are only available for eligible profiles that successfully complete the verification process. The benefits include a verified badge, account protection, account support, exclusive features.
2024	Customized stickers in Stories
2024	Development of Instagram AI

Sources:

About Instagram <https://about.instagram.com/about-us>

Instagram Help Center <https://help.instagram.com>

Instagram Timeline on Wikipedia https://en.wikipedia.org/wiki/Timeline_of_Instagram

Postbuilderapp <https://postbuilderapp.com/blog/instagram-history-and-updated-timeline>

Statista <https://www.statista.com/statistics/183585/instagram-number-of-global-users>

Appendix 2 Multilingual dictionaries for automatic content analysis

1 Food

1.1 Dutch Food

Pesticide, landbouw, droogte, overbevissing, permacultuur, compost, compostering, vlees, groente, fruit, tuin, biologisch, voedsel, eten, voedsel, agro-ecologie, vegetarisch

1.2 English Food

Pesticide, agriculture, drought, overfishing, CAP, permaculture, compost, meat, vegetable, fruit, garden, organic product, food, eat, feed, vegetarian, vegan

1.3 French Food

Pesticide, agriculture, sécheresse, surpêche, CAP, permaculture, compostage, composter, viande, légume, fruits, jardin, produit bio, alimentaire, alimentation, manger, se nourrir, s'alimenter, végétarien, vègan, potager

1.4 Norwegian Food

Plantevernmidler, landbruk, tørke, overfiske, permakultur, kompost, kjøtt, grønnsak, frukt, hage, organisk produkt, mat, maten, spise, spiser, spiste, spist, mate, mater, matet, plantevernmiddelrester, plantevernmiddelbruk, plantevernmiddelregelverk, plantevernmiddelresistens, plantevernmiddelresistensen, plantevernmiddelforskrift, permakulturforening, permakulturell, permakulturdessign, økologisk, jordforurensning, landbruksforurensning, kompost, kompostering, komposten, komposteres, kompostert, kompostbinge, kompostere, kompostjord, komposthaug, komposthaugen, komposteringsanlegg, komposterer, kompostgjerd, komposteringen, komposteringsprosessen, komposterbare, komposter, komposterbar, komposterbart, komposteringsanlegget, kompostbeholdere, komposterings, kompostanlegg, komposteringsprosess, kompostprodukter, komposterte, kompostjorden, kompostjorda, kompostanlegget, vegetarisk,vegan, vegansk, veganer

2 Transport

2.1 Dutch Transport

Transport, trein, fiets, auto, vliegtuig, boot, autorijden, fietser, fietspad, vliegen, rails, snbc, suv, diesel, snelweg, sncf, tesla, stopsuv, scooter, wandelen, skeeleren, bus, luchthaven

2.2 English Transport

Transport, train, bike, car, plane, boat, drive, cyclist, bike path, fly, rails, sncf, snbc, suv, diesel, highway, tesla, oil industry, petroleum, stopsuv, scooter, walking, rollerblading, bus, airport

2.3 French Transport

Transport, train, vélo, voiture, avion, bateau, conduire, cycliste, piste cyclable, voler, rails, sncf, snbc, suv, diesel, essence, gazoil, autoroute, tesla, stopsuv, trotinette, marche à pied, rollers, Roissy, bus, aéroport, tramway, covoiturage, métro

2.4 Norwegian Transport

Transportere, tog, sykkel, sykkelvei, sykkelsti, elbil, elbilen, elbiler, elbilene, elbåt, elbåten, elbåter, elbåtene, elfly, elflyet, elflyene, bil, bilen, biler, bilene, fly, flyet, flyene, båt, båten,

båter, båtene, syklist, syklist, syklistene, sykkelsti, sykkelstien, sykkelstier, sykkelstiene, skinner, suv, diesel, bensin, hovedvei, motorvei, motorveien, motorveier, motorveiene, tesla, teslaen, teslaer, teslaene, solcelledrive, solcelledrevet, solcelledrevne, solcellebil, solcellefly, solcellebåt, buss, bussen, busser, bussene, trikk, trikken, trikker, trikkene, bybane, bybanen, bybaner, bybanene, flyplass, flyplassen, flyplasser, flyplassene

3 Energy

3.1 Dutch Energy

Energie, fotovoltaïsch, fossiel, groene energie, energietransitie, elektriciteit, verwarming, gas, energiebeleid, gascentrale, kernaafval, kerncentrale, kernenergie, kernuitstap, batterij, zonne-energie, windenergie, windmolen

3.2 English Energy

Energy, photovoltaics, fossil fuel, fossil energy, green energy, energy transition, fossil, electricity, heating, gas, nuclear, battery, solar cell, solar energy, wind energy, wind turbine,

3.3 French Energy

Énergie, photovoltaïque, combustible fossile, énergie fossile, énergie verte, transition énergétique, fossile, électricité, chauffage, gaz, nucléaire, batterie, énergie solaire, éolienne,

3.4 Norwegian Energy

Energi, fotovoltaisk, fossilt brensel, fossil energi, grønn energi, energiovergang, fossil, elektrisitet, oppvarming, gass, solcelle-anlegg, solcelle-panel, solcelle-teknologi, solcelle-energi, sol celle, oljeindustri, oljeindustrien, oljeindustriens, oljeindustripolitisk, oljeindustriell, oljeindustrielle, oljeindustrien, oljeindustripolitiske, oljeprodusent, oljeprodusenter, oljeprodusentene, oljeforurensning, oljeforurensningen, solcelle, solceller, solcellepanel, solcelleanlegg, solcelleanlegget, solcelledreven, solcelleteknologi, solcelleindustri, solcellelampe, solcellepark, solcellelader, solcellestrøm, solcellestrømmen, solcelleregulator, solcellesystem, solcellesilisium, solcelleproduksjon, solcelledrevet, solcelleanlegget, solcelleenergi, solcellebatteri, solcellebatteriet, solcellebatterier, solcellebatteriene, solcellekraftverk, solcellekraftverket, solcelleinstallasjon, solcelleinstallasjonen solcellefasade, solcellepanelet, energiomstilling, fossiltbrennstoff, batteri, vindmølle, vindmøllen, vindmøller, vindmøllene, vindpark, vindparker, vindparkene vindmøllepark, vindmølleparken, vindmølleparkene, kjernekraft, kjernekraften, atomenergi, atomenergien, atomkraft, atomkraften, elektrisitet

Appendix 3 Preliminary codebook for multimodal content analysis

11 pilot categories applied to the testing set of data

Climate change themes

1. Is the post related to CC or environmental topics? - Closed question (one answer)

Answer options: Yes/No

2. Which theme is present in the message? - Closed question with multiple answers possible

Answer options: Food/Energy/Transport/other

3. If you chose *Food/Energy/Transport* theme in Question 2, which sub-theme is mentioned in the post? - Open question (multiple answers possible)

Climate actions and actors

4. Which climate actions related to solutions to CC mitigation are represented in Instagram posts? - Open question

5. Which type of climate action related to solutions to CC mitigation is represented in Instagram posts? - Closed question (one answer)

Answer options: individual/group

6. Which type of climate action related to solutions to CC mitigation regarding geographical aspect is represented in Instagram posts? - Closed question (one answer)

Answer options: global/local

7. Which actors are represented as responsible for CC mitigation? - Open question

Obstacles

8. Which obstacles to CC mitigation are represented? - Open question

9. Who/what is criticized in the post for not contributing to CC mitigation? - Open question

Values

10. Which environmental values are represented in the posts? - Closed question (one answer)

Answer options: biospheric/altruistic/egoistic/hedonic

11. How is an environmental value presented in the post regarding the environmental value items proposed by (Steg, Perlaviciute, et al., 2014)?

Answer options for **Biospheric value cluster** (multiple answers possible):

- ☐ Preventing pollution (protecting natural resources) - It is important to prevent environmental pollution

- ☐ Protecting the environment (preserving nature) - It is important to protect the environment
- ☐ Respecting the Earth (harmony with other species) - It is important to respect nature
- ☐ Unity with nature (fitting into nature) - It is important to be in unity with nature

Answer options for **Altruistic value cluster** (multiple answers possible):

- ☐ Equality (equal opportunity for all) - It is important that every person has equal opportunities
- ☐ Social justice 1 (correcting injustice) - It is important that every person is treated justly
- ☐ Social justice 2 (care for the weak) - It is important to take care of those who are worse off
- ☐ A world at peace (free of war and conflict) - It is important that there is no war or conflict
- ☐ Helpful (working for the welfare of others) - It is important to be helpful to others

Answer options for **Hedonic value cluster** (multiple answers possible):

- ☐ Pleasure (gratification of desires) - It is important to have fun
- ☐ Enjoying life (enjoying food, sex, leisure, etc.) - It is important to enjoy the life's pleasures
- ☐ Self-indulgent (doing pleasant things) - It is important to do things that you enjoy

Answer options for **Egoistic value cluster** (multiple answers possible):

- ☐ Social power (control over others) - It is important to have control over others' actions
- ☐ Authority (the right to lead command) - It is important to have authority over others
- ☐ Influential (having an impact on people and events) - It is important to be influential
- ☐ Wealth (material possessions, money) - It is important to have money and possessions
- ☐ Ambitious (hard-working, aspiring) - It is important to work hard and be ambitious

Appendix 4 Multimodal content analysis codebook

The orange highlighted categories are the categories modified from the preliminary codebook.

Climate change themes

1. Is the post related to CC or environmental topics? - Closed question (one answer)
Answer options: Yes/No
2. Which theme is present in the message? - Closed question with multiple answers possible
Answer options: Food/Energy/Transport/other
3. If you chose *Food/Energy/Transport* theme in Question 2, which sub-theme is mentioned in the post? - Open question (multiple answers possible)

Climate actions and actors

4. Which climate actions related to solutions to CC mitigation are represented in Instagram posts? - Open question
5. Which actors are represented as responsible for CC mitigation? - Open question

Obstacles

6. Which obstacles are represented and how? - Open question
7. Who/what is criticized in the post? - Open question

Values

8. Which environmental values are represented in the posts? - Closed question (one answer)
Answer options: biospheric/altruistic/egoistic/hedonic
9. How is an environmental value presented in the post, based on the environmental value items proposed by Steg et al. (2014) and Schwartz (1992)?

Answer options for **Biospheric value cluster** (multiple answers possible):

- ☐ Preventing pollution (protecting natural resources) - It is important to prevent environmental pollution
- ☐ Protecting the environment (preserving nature) - It is important to protect the environment
- ☐ Respecting the Earth (harmony with other species) - It is important to respect nature
- ☐ Unity with nature (fitting into nature) - It is important to be in unity with nature

Answer options for **Altruistic value cluster** (multiple answers possible):

- ☐ Equality (equal opportunity for all) - It is important that every person has equal opportunities
- ☐ Social justice (correcting injustice, care for the weak) - It is important that every person is treated and to take care of those who are worse off
- ☐ A world at peace (free of war and conflict) - It is important that there is no war or conflict

- ☐ Helpful (working for the welfare of others) - It is important to be helpful to others
- ☐ Health (not being sick physically or mentally) - It is important that everybody is healthy

Answer options for **Hedonic value cluster** (multiple answers possible):

- ☐ Pleasure (gratification of desires) - It is important to have fun
- ☐ Enjoying life (enjoying food, sex, leisure, etc.) - It is important to enjoy life's pleasures
- ☐ Self-indulgent (doing pleasant things) - It is important to do things that you enjoy
- ☐ Comfort - It is important to be in comfortable conditions, not to change habits
- ☐ Satisfaction of accomplishment - it is important to be satisfied with a completed task
- ☐ Inner harmony - it is important to be at peace with myself

Answer options for **Egoistic value cluster** (multiple answers possible):

- ☐ Social power (control over others) - It is important to have control over others' actions
- ☐ Authority (the right to lead command) - It is important to have authority over others
- ☐ Influential (having an impact on people and events) - It is important to be influential
- ☐ Wealth (material possessions, money) - It is important to have money and possessions
- ☐ Ambitious (hard-working, aspiring) - It is important to work hard and be ambitious
- ☐ Social recognition - it is important to be respected or approved by others
- ☐ Successful - it is important to achieve your goals
- ☐ Health - it is important for my PERSONAL health

10. Which environmental values and value clusters are related to the identified obstacles in the post, based on the environmental value items proposed by (Steg, Perlaviciute, et al., 2014) ?

Answer options for **Biospheric value cluster** (multiple answers possible):

- ☐ Preventing pollution (protecting natural resources) - It is important to prevent environmental pollution
- ☐ Protecting the environment (preserving nature) - It is important to protect the environment
- ☐ Respecting the Earth (harmony with other species) - It is important to respect nature
- ☐ Unity with nature (fitting into nature) - It is important to be in unity with nature

Answer options for **Altruistic value cluster** (multiple answers possible):

- ☐ Equality (equal opportunity for all) - It is important that every person has equal opportunities
- ☐ Social justice (correcting injustice, care for the weak) - It is important that every person is treated and to take care of those who are worse off
- ☐ A world at peace (free of war and conflict) - It is important that there is no war or conflict
- ☐ Helpful (working for the welfare of others) - It is important to be helpful to others
- ☐ Health (not being sick physically or mentally) - It is important that everybody is healthy

Answer options for **Hedonic value cluster** (multiple answers possible):

- ☐ Pleasure (gratification of desires) - It is important to have fun
- ☐ Enjoying life (enjoying food, sex, leisure, etc.) - It is important to enjoy life's pleasures
- ☐ Self-indulgent (doing pleasant things) - It is important to do things that you enjoy
- ☐ Comfort - It is important to be in comfortable conditions, not to change habits
- ☐ Satisfaction of accomplishment - it is important to be satisfied from a completed task
- ☐ Inner harmony - it is important to be at peace with myself

Answer options for **Egoistic value cluster** (multiple answers possible):

- ☐ Social power (control over others) - It is important to have control over others' actions
- ☐ Authority (the right to lead command) - It is important to have authority over others
- ☐ Influential (having an impact on people and events) - It is important to be influential
- ☐ Wealth (material possessions, money) - It is important to have money and possessions
- ☐ Ambitious (hard-working, aspiring) - It is important to work hard and be ambitious
- ☐ Social recognition - it is important to be respected or approved by others
- ☐ Successful - it is important to achieve your goals
- ☐ Health - it is important for my PERSONAL health

Appendix 5 Preliminary codebook for content analysis of the comments

Obstacles

1. Does the comment directly or indirectly introduce or evoke the obstacle to pro-environmental action? - Closed question (one answer)

Answer options: Yes / No

2. Illustrate the obstacle with the example phrase from the comment. - Open question

3. How can the obstacle be described? - Open question

Values

4. Which environmental value in relation to obstacle is present in the comment? - Closed question

Answer options: biospheric/altruistic/egoistic/hedonic/no answer

5. How is environmental value presented, based on the environmental value items proposed by Steg et al. (2014) and Schwartz (1992)??

Answer options for **Biospheric value cluster** (multiple answers possible):

- ☐ Preventing pollution (protecting natural resources) - It is important to prevent environmental pollution
- ☐ Protecting the environment (preserving nature) - It is important to protect the environment
- ☐ Respecting the Earth (harmony with other species) - It is important to respect nature
- ☐ Unity with nature (fitting into nature) - It is important to be in unity with nature

Answer options for **Altruistic value cluster** (multiple answers possible):

- ☐ Equality (equal opportunity for all) - It is important that every person has equal opportunities
- ☐ Social justice (correcting injustice, care for the weak) - It is important that every person is treated and to take care of those who are worse off
- ☐ A world at peace (free of war and conflict) - It is important that there is no war or conflict
- ☐ Helpful (working for the welfare of others) - It is important to be helpful to others
- ☐ Health (not being sick physically or mentally) - It is important that everybody is healthy

Answer options for **Hedonic value cluster** (multiple answers possible):

- ☐ Pleasure (gratification of desires) - It is important to have fun

- ☐ Enjoying life (enjoying food, sex, leisure, etc.) - It is important to enjoy the life's pleasures
- ☐ Self-indulgent (doing pleasant things) - It is important to do things that you enjoy
- ☐ Comfort - It is important to be in comfortable conditions, not to change habits
- ☐ Satisfaction of accomplishment - it is important to be satisfied from a completed task
- ☐ Inner harmony - it is important to be at peace with myself

Answer options for **Egoistic value cluster** (multiple answers possible):

- ☐ Social power (control over others) - It is important to have control over others' actions
- ☐ Authority (the right to lead command) - It is important to have authority over others
- ☐ Influential (having an impact on people and events) - It is important to be influential
- ☐ Wealth (material possessions, money) - It is important to have money and possessions
- ☐ Ambitious (hard-working, aspiring) - It is important to work hard and be ambitious
- ☐ Social recognition - it is important to be respected or approved by others
- ☐ Successful - it is important to achieve your goals
- ☐ Health - it is important for my PERSONAL health

Narrative roles

6. Who or what is mentioned responsible to act for CC mitigation in the comment (hero)?

Open question

7. What is represented as the villain in the comments or whose irresponsible behaviors towards CC mitigation are criticized in the comment (villain)? Open question

8. Who or what is mentioned as harmed in the comments (victim)? Open question

Appendix 6 Codebook for the content analysis of the comments

Obstacles

1. Does the comment directly or indirectly introduce or evoke the obstacle to pro-environmental action? - Closed question (one answer)

Answer options: Yes / No

2. Illustrate the obstacle with the example phrase from the comment. - Open question

3. How can the obstacle be described? - Open question

4. Which category of obstacle can be attributed to the observed obstacle? - Close question

Answer options:

- ☐ *Actions of other laypeople* – when actions of other laypeople (not politicians or company leaders) somehow negatively interfere in the CC mitigation process and sustainable development practices
- ☐ *Actions of companies/organizations* – when actions of companies, organizations, and their leaders negatively influence the CC mitigation process and sustainable development practices
- ☐ *Health* – when someone does not contribute to pro-environmental action or claims other people not to do so due to their health conditions, it can also be related to the negative influence of the action on the health of the individual.
- ☐ *Choice* – when someone does not contribute to pro-environmental action because there are not enough options or choices proposed or because they do not like being obliged and not given any choice
- ☐ *State authorities (in)action* – when actions or inactions by state authorities do not contribute or are opposed to the sustainable development and CC mitigation policies
- ☐ *Stereotypes* – when stereotypical opinion present in society influences the opinion of someone not to contribute to climate action. For example, the stereotype that meat is a food for strong and healthy men can sometimes be used as an explanation or an excuse not to reduce meat consumption
- ☐ *Organizing the action* – when different factors related to the organization of the action influence a person's indifference to climate action
- ☐ *Money* – when someone does not have enough financial resources to contribute to pro-environmental action or when the action is considered too expensive for a person
- ☐ *Food quality and characteristics* – when someone refuses to contribute to sustainability transition in the food sector because some sustainable food practices, according to this person, negatively influence food quality, taste, and other characteristics
- ☐ *Communication and knowledge issues* – when people do not contribute to CC mitigation because they do not possess sufficient information about it or this information is controversial in different available sources.
- ☐ *Feelings and individual conditions* – when different personal conditions and feelings influence the choice of a person not to contribute to climate action, for

example, when someone feels that his or her action will not significantly contribute to global change

Values

5. Which environmental value in relation to the obstacle is present in the comment? - Closed question

Answer options: biospheric/altruistic/egoistic/hedonic/no answer

6. How is an environmental value presented, based on the environmental value items proposed by Steg et al. (2014) and Schwartz (1992)??

Answer options for **Biospheric value cluster** (multiple answers possible):

- ☐ Preventing pollution (protecting natural resources) - It is important to prevent environmental pollution
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- ☐ A world at peace (free of war and conflict) - It is important that there is no war or conflict
- ☐ Helpful (working for the welfare of others) - It is important to be helpful to others
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- ☐ Self-indulgent (doing pleasant things) - It is important to do things that you enjoy
- ☐ Comfort - It is important to be in comfortable conditions, not to change habits
- ☐ Satisfaction of accomplishment - it is important to be satisfied from a completed task
- ☐ Inner harmony - it is important to be at peace with myself

Answer options for **Egoistic value cluster** (multiple answers possible):

- ☐ Social power (control over others) - It is important to have control over others' actions
- ☐ Authority (the right to lead command) - It is important to have authority over others
- ☐ Influential (having an impact on people and events) - It is important to be influential
- ☐ Wealth (material possessions, money) - It is important to have money and possessions
- ☐ Ambitious (hard-working, aspiring) - It is important to work hard and be ambitious
- ☐ Social recognition - it is important to be respected or approved by others
- ☐ Successful - it is important to achieve your goals
- ☐ Health - it is important for my PERSONAL health

Narrative roles

7. Who or what is mentioned responsible to act for CC mitigation in the comment (hero)?

Open question

8. What is represented as the villain in the comments or whose actions or irresponsible behaviors towards CC mitigation are criticized in the comment (villain)? Open question

9. Who or what is mentioned as harmed in the comments (victim)? Open question

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CATHOLIC UNIVERSITY OF LOUVAIN

Faculty of Economic, Social, and Political Sciences and Communication

Place Montesquieu, 4bte L2.05.01, 1348 Louvain-la-Neuve, Belgium | www.uclouvain.be/espo