Safety, security, and the unintended implications of cutting the academic ties with the fossil fuel industry

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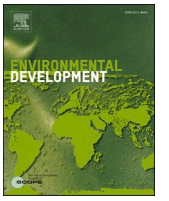

Safety, security, and the unintended implications of cutting the academic ties with the fossil fuel industry

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ABSTRACT

In recent years, the relationship between academia and the fossil fuel industry has become a focal point of intense debate. This concern arises from the fear that corporate funding might skew research activities. A significant development in this area is the adoption of policies by a Dutch university, and discussions in several others, prohibiting research funded by the fossil fuel industry. These policies aim to safeguard academic freedom and integrity. Despite this, there has been little discussion on the myriad challenges, implications, and possible unintended consequences, particularly in the realm of safety-and-security research. As such, this manuscript delves into the complex transition towards a fossil-fuel-free society, examining it through the lenses of safety science and sociotechnical systems. It emphasizes the vital importance of collective responsibility in ensuring systemic safety and security as we navigate towards achieving the sustainable development goals. This journey requires a delicate balance between the objectives of safety and sustainability, along with a deep understanding of the security implications of decreasing our dependence on the fossil fuel industry. The strategy of distancing academic research from fossil fuel industries, commonly seen as a positive step, also demands a nuanced consideration of its broader impacts, including the setting of precedents for addressing other existential and systemic risks. Instead, we argue for the establishment of robust governance structures rooted in restorative justice principles. Such frameworks can facilitate productive dialogue with underrepresented groups, motivate the fossil fuel industry towards sustainable practices, and safeguard the integrity of scholarly research. This approach not only addresses immediate concerns related to fossil fuels but also lays the groundwork for a more inclusive and equitable model of climate risk research, essential for tackling the multifaceted challenges of our era.

1. Introduction

The discourse regarding the relationship between academia and the fossil fuel industry has gained significant momentum. There is a growing sentiment that universities should distance themselves from the fossil fuel sector to uphold the objectivity of their research. This call for separation is rooted in the well-documented unethical behaviour of the fossil fuel industry, which numerous studies have linked to engagement in misinformation campaigns (Farrell, 2019), interference in policymaking through campaign contributions and lobbying efforts (Lucas, 2021; Wright et al., 2021), obstruction of climate action and the transition to clean energy (Si et al., 2023; Ferns and Amaeshi, 2021), and the concealment of critical information linking fossil fuels to global warming. In this context, a university in the Netherlands has taken a pioneering step by implementing a fossil-fuel-free research policy. This move aims to mitigate the potential influence of fossil fuel corporations on academic endeavours (Cohen, 2023). Many other universities around the world are actively deliberating similar initiatives and engaging in debates about their future collaborations with the fossil fuel industry. The

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importance of these debates is highlighted even more by evidence showing that previous academic research collaborations with the industry have been exploited in disinformation campaigns about climate change (Hiltner et al., 2024; Supran and Oreskes, 2017, 2021). These discussions stem from growing concerns about research bias that may arise from funding received from the fossil fuel sector. Indeed, the call for fossil-fuel-free research policies is gaining recognition as a vital stride in promoting impartial and effective climate research. This situation can reshape both industry practices and academic engagement in the future. Therefore, rigorous discussion of these developments is needed to understand their impact on the evolving relationship between academic institutions and the fossil fuel sector.

In today's academic landscape, researchers are increasingly aligning their efforts with the Sustainable Development Goals (SDGs) and incorporating Responsible Research and Innovation (RRI) into their practices. However, the prospect of collaborating with the fossil fuel industry presents a significant challenge to these initiatives. As universities and research institutions strive to safeguard the objectivity of scholarship, this task is complicated by the fossil fuel sector's well-known resort to 'greenwashing' — where companies misleadingly exaggerate or falsely claim environmental benefits— undermining the credibility of genuine sustainable efforts (Sharmina, 2022; Sheehan, 2018). Studies have shown that greenwashing can significantly sway public attitudes, making individuals more favorable toward the environmental actions of fossil fuel companies. More concerning is the observation that the misleading effects of greenwashing are so profound that even subsequent exposure to facts—such as the minimal investment by oil and gas companies in renewable energy compared to fossil fuels—fails to completely negate the influence of initial misleading advertisements on perceptions of corporate (Friedman et al., 2023).

Additionally, maintaining objectivity in scholarship is also complicated by the fossil-fuel sector's broader strategy of corporate capture and deliberate undermining of climate science. Historical analyses show how hydro-carbon companies have leveraged lobbying power and sponsorship to steer the agendas of decision-making for a – including recent COP meetings – while funding campaigns designed to manufacture uncertainty about the scientific consensus (Oreskes and Conway, 2010). For instance, internal documents have shown that company scientists have quantified the risks associated with anthropogenic warming decades prior to James Hansen's 1988 testimony. Yet, respective executives continued to bankroll denialist narratives that impeded policy action (Friedman et al., 2023). Therefore, engaging with industries that deploy deceptive and capture strategies jeopardises the credibility of university research, and risks delaying the systemic transitions required for genuine sustainability (Sharmina, 2022; Sheehan, 2018). Consequently, a critical re-evaluation of the ties between universities and the fossil fuel sector is an imperative and responsible approach to support sustainability efforts, necessitating careful deliberation given the significant implications of such relationships.

In the field of safety and security science, various inherent factors must be taken into account when reassessing collaborations, including the possibility of ending associations with the fossil fuel industry. While the moral and environmental imperatives of such decisions are evident, navigating this transition requires a nuanced understanding of its safety and security implications. This is particularly important as the decision to disengage has far-reaching implications, affecting not only research funding and stakeholder engagement but also reshaping the risk landscape. Historically, research collaboration with the fossil fuel industry on process safety has originated many well-known safety models, concepts, and theories (Swuste et al., 2022). These advancements have brought significant direct benefits to society, both from an environmental and human perspective as such methods have found applications to improve safety in other sectors such as the FMEA in aerospace, automotive and manufacturing (Sharma et al., 2018; Wu et al., 2021) and the HAZOP in the biopharmaceuticals (de la O Herrera et al., 2015). Furthermore, severing ties between industry and academia would mean a transition from a well-understood environment, where risks and mitigation measures have undergone extensive study, to unfamiliar terrain that may introduce potential unforeseen vulnerabilities. The wealth of historical data and insights gleaned from longstanding collaborations with the fossil fuel industry has empowered researchers to anticipate and address specific challenges. The act of severing these ties may necessitate a recalibration of safety and security protocols, demanding a new level of expertise and understanding. It is essential to recognize that any transition from the current state to a fossil-fuel-free state is a gradual process that cannot happen overnight (Clarke et al., 2014). Such transitions require a significant amount of time, and inevitably, safety and security issues will arise during this transitional period, which warrants objective study. For instance, in the transportation domain, there are billions of fossil-fuel vehicles, both private and public, in use globally. The shift toward a fossil-fuel-free transport system does not signify an instant disappearance of these vehicles. Instead, the transport system will have both types of vehicles on its infrastructure until they can be gradually replaced by fossil-fuel-free alternatives. Throughout this transitional period, safety incidents must be explored and investigated within academia.

There is no doubt that the field of safety and security must navigate the challenges arising from the calls for separation between academia and the fossil fuel industry. Aiming to achieve a harmonious balance between safety, security, and sustainability, this paper sets out to critically examine the safety and security considerations involved in severing collaborations between scholars and the fossil fuel sector. Through this discussion, we provide insights and recommendations that can guide policymakers, academia, and the industry towards more ethical and sustainable practices amidst these evolving challenges.

2. Considerations of system safety and security in university policies for fossil fuel divestment

In the first part of this manuscript, we want to consider that the fossil fuel industry, like many others, involves thousands of workers — often with very limited power or influence over corporate decisions, which are typically made by executives — and operates in communities that are directly exposed to the risks of its activities. Some of these risks include workplace incidents, such as chemical exposures and adverse environmental impacts. Often, safety and security academics work directly with the industry, providing knowledge to enhance their safety and security processes. Indeed, addressing the safety and security challenges posed by the fossil fuel industry requires a collaborative and holistic systems approach. As noted in contemporary safety and security science, individualized,

reductionist strategies to increase safety and security are inadequate in today's complex landscape (Rasmussen, 1997; Salmon et al., 2014). The socio-technical systemic perspective suggests that challenges are rooted in an intricate matrix of decisions made at various levels of the system, encompassing not just industry players but also regulatory bodies and governmental actors (Rasmussen, 1997). Indeed, Reason (2000) posits that an effective safety strategy should both reduce the occurrence of incidents and construct systems resilient enough to manage them. However, applying this comprehensive socio-technical systems perspective in relation to the fossil fuel industry is challenging, if not impossible, without industry collaboration. Severing and/or reducing ties between research and industry, without a completely new way of governing the system, may limit the insights and cooperation needed to design and implement these systemic interventions effectively. Given that these interventions necessitate understanding and collaboration from various stakeholders, it is pivotal for both academia and the industry to maintain open channels for effective, system-wide reform.

A collaborative, systems-oriented approach is especially valuable when assessing the risks of fully severing ties between research and the fossil fuel industry. Disengagement may result in reduced access to real-time data or technical insights into ongoing operations—such as deep-sea drilling—that are necessary to monitor environmental and safety risks. Without such information, researchers may be less equipped to advise on disaster prevention or mitigation, as highlighted by the Deepwater Horizon oil spill in 2010. Knowledge gaps of this kind could leave communities and ecosystems more vulnerable to immediate harms. At the same time, we acknowledge the ethical complexity of collaborating with industries that are central contributors to the climate crisis. Our argument is not that academic engagement should prolong the fossil fuel era, but rather that, while fossil operations remain active, researchers may play a role in reducing near-term risks. This form of engagement must be tightly bounded: it should not be used to justify business-as-usual or delay transitions. As the planetary boundaries framework makes clear (Rockström et al., 2009), urgent structural shifts are necessary, and academic collaborations must align with—rather than distract from—that imperative.

When thinking about energy transition initiatives, some scholars argue that continued collaboration with the fossil fuel industry may help manage transitional risks. However, it is important to recognize that narratives such as natural gas as a "bridge fuel," or mechanisms like carbon credits and carbon capture, have been widely criticized. These approaches have, at times, delayed meaningful climate action by promoting incremental improvements while sustaining fossil fuel dependency. In particular, carbon credit systems often lack clear standards, and there is limited evidence that such offsets lead to real emissions reductions, especially when used to justify ongoing pollution rather than drive internal decarbonization (Trouwloon et al., 2023). Similarly, recent modelling of carbon capture and utilization shows that market rebound effects can partially or fully offset the environmental benefits of capture, unless carefully regulated (Cabrera et al., 2022). Ultimately, the credibility of fossil-funded research hinges not only on transparency but also on whether such collaborations lead to measurable emission reductions—or merely serve to prolong the status quo.

Security issues could also arise when academic institutions adopt fossil-free research policies and distance themselves from the fossil fuel sector. Firstly, as universities and the fossil fuel industry engage with new stakeholders, vulnerabilities emerge due to the lack of previous experience and often divergent trajectories. Well-established relationships reduce risks, especially in critical systems with participation of the fossil fuel industry, such as energy. This is because long-standing collaborations often have established security protocols that help protect against various threats. New stakeholders also represent new uncertainties, and this transition could leave Western countries more exposed to interference and attacks by malicious geopolitical actors. Engaging with these new partners opens a window for adversaries to exploit vulnerabilities, potentially undermining security and interests in the context of global energy research and collaboration. Secondly, in the absence of universities, consultancy firms might fill the knowledge gap in safety, potentially introducing security risks. These firms may not have the same academic rigor and research ethics, potentially compromising the confidentiality and quality of safety measures. This issue is exacerbated by the often absent shared responsibility between consulting entities and their industry partners (Sturdy et al., 2009; Sennett, 2007 ; Froud et al., 2000). Lastly, isolating the fossil fuel industry from academic interactions can make them more vulnerable to security threats. Knowledge-sharing activities within multi-actor organizations, like industrial clusters, are vital for staying informed about evolving security risks and implementing effective countermeasures. Without these collaborations, the industry may struggle to adapt to emerging security challenges.

Changes in how academic research is funded and who partners with these institutions affect not just their financial health but also open up security risks. Misinformation campaigns, aimed at discrediting initiatives led by universities, are a clear example of such risks. For instance, if a university enters into a partnership with an emerging clean energy company, it may become the target of reputational attacks from actors with vested interests in fossil fuel markets. These narratives—often amplified by industry-backed think tanks, lobbying groups, or aligned media outlets—can question the ethics or viability of clean technologies, sowing doubt about their environmental benefits. The spread of such misinformation can erode public trust and hinder the broader transition to sustainable energy systems.

To be clear, this is not an argument against student activism or criticism of fossil fuel partnerships, nor does it suggest that clean energy collaborations carry the same level of risk as working with fossil fuel companies. Rather, it underscores how even sustainability-oriented efforts can be met with resistance and misinformation by incumbents seeking to maintain influence. Therefore, divestment should be studied carefully, and safeguards put in place to manage potential risks. Before making any decisions, a comprehensive assessment of potential consequences, both intended and unintended, from safety and security perspectives should be carried out. This proactive approach will enable universities to effectively manage risks and safeguard their research, resources, and reputation in this evolving landscape.

A final consideration is that academics and universities also collaborate with society and governing bodies to shape policy, establish norms and standards, and provide expert witness accounts with regard to safety and security risks. However, when access to information is restricted, it can lead to lower-quality advice and increased uncertainties. Gaining knowledge on possible safety and security risks should comprehend both broad and long-term effects as history shows us that we cannot know or estimate everything beforehand, e.g., CFCs, asbestos. But also, potential risks often emerge from complex interactions and external relationships which can be hard to

'test' within laboratory settings. For instance, the discovery that chemicals in tires can react with ozone from the atmosphere after which a hazardous compound forms, only came to light after numerous coho salmon in the US pacific Northwest unexpectedly died (Tian et al., 2021), or the alarming skewed sex ratio for sea turtles due to a rise in temperature of coastal sand was led back to micro-plastics (Fuentes et al., 2023). This underscores the value of a symbiotic relationship where research guides industry safety and security practices, and the industry provides the practical context and insights needed to advance safety science and develop systemic interventions.

3. The critical role of shared responsibility in risk management

Shared responsibility enhances system safety by ensuring that all stakeholders collaborate to identify, reduce, and manage risks. It also helps prevent oversights and negligence by distributing accountability across the system. Additionally, it fosters cross-disciplinary collaboration, drawing on diverse expertise to build a more comprehensive and resilient safety framework.

While the fossil fuel industry is often criticized for its carbon emissions and contribution to climate change, it is essential to recognize the shared responsibility within the system. Society, governments, and industries are interconnected, and it is not solely about placing blame on one entity. Governments have significant power and resources and thus can be held accountable for not pushing for greener alternatives using policies, standards, and incentives (Roy and Woerdman, 2016). We must also consider how society, citizens, and various industries utilize fossil fuels and manage their emissions. However, taking a broader perspective should not diminish the accountability of the fossil fuel sector. The fossil fuel industry has a documented history of deception, lack of transparency, and efforts to obfuscate the genuine environmental repercussions of its operations (Supran et al., 2017; Brulle, 2018; Oreskes and Conway, 2010). Still, it is crucial to understand that many stakeholders play a role, and all should be proactive and receptive to addressing the issue collectively.

Another dimension of this conundrum is that sociotechnical approaches to research also ask us to not just look at individual interactions between actors, industry-academia, but to consider all levels of the system, such as governments, consumers, etc. This relates to the case of indirect collaborations when developing system-wide interventions. In some cases, academia indirectly collaborates with the fossil fuel industry when policymakers, practitioners, and experts come together to address collective safety concerns. As an example, consider a project that seeks collaboration to form a safety cluster. In this initiative, stakeholders collaborate to improve safety by sharing their experiences and identifying early warning signals from the vast amount of data collected by petrochemical companies (van Nunen et al., 2020). These signals serve as early indicators of potential safety issues, allowing us to address safety concerns before they become major problems. This type of research is incredibly important for safety, as it provides evidence-based strategies for companies on how to jointly improve safety within industrial clusters. As a safety and security researcher, it is unfeasible to help develop safety interventions in the (petro)chemical industry without somehow relating to the fossil fuel industry, as they are intimately interconnected. In navigating this complex terrain, it becomes evident that maintaining research integrity while collaborating with the fossil fuel industry is paramount to ensure that the pursuit of sustainability remains genuine and effective. This form of collaboration with the industry emphasizes that fossil fuel companies share responsibility for their sector's and society's well-being, not just their own results. It shows the need for a joint effort in safety, involving the whole industry and its societal effects. This approach promotes a united and accountable way to tackle safety and sustainability, highlighting every stakeholder's role in benefiting the common good.

Shared responsibility also calls for a stronger role of governments and regulatory bodies in managing risks such as climate change. Their task is to oversee and ensure public safety through detailed planning and the provision of strong evidence, while also promoting innovation. There have been cases demonstrating that industries, without adequate oversight and a concerted effort to proactively mitigate risks, have resulted in harm. A prime example in this area is the management of PFAS (Kwiatkowski et al., 2020) and glyphosate (Casassus, 2023), chemicals with significant environmental and health risks such as cancers and developmental issues. The regulatory system's weaknesses and lack of proactivity lead to situations where practices continue because of a lack of comprehensive safety data – sometimes undeliberate, sometimes deliberate – the latter being known as the 'no data-no problem' scenario (Bouchaut et al., 2022). This issue highlights the importance of improving structures to support industry-academia collaborations, thereby contributing to transparency, and that aligns with sustainability goals, emphasizing the gap in effectively fostering these engagements for enhanced sustainability efforts.

4. Implications for ties with other industries posing existential and systemic safety or security risks

The fossil fuel industry's impact on the climate poses an existential risk, which could be a reason for academic institutions to distance themselves from further collaborations with that industry. However, in today's interconnected world, humanity is confronted with a spectrum of threats with existential and systemic risks looming prominently. Existential risks pose threats that could drastically reduce humanity's potential or even lead to our total extinction, typically affecting populations globally. Systemic risks, meanwhile, trigger cascading failures across interconnected systems, resulting in societal, economic, or environmental collapses. A paramount example of both is climate change, which manifests in myriad ways: from global impacts spanning polar regions to urban centers, feedback loops like the melting polar ice, which reduces Earth's reflectivity, to disruptions in agriculture and the subsequent economic, societal, and biodiversity repercussions.

Besides climate change, other safety events are related to existential and systemic risks of anthropogenic nature.

- Artificial Intelligence (AI): As AI becomes deeply integrated across sectors like healthcare and defence, unchecked developments might misalign with human values, introducing significant threats. The potential for an autonomous AI system acting counter to human interests is a growing concern.
- Biotechnological Innovations: Mismanaged or unintended consequences of biotechnology could result in uncontrollable pandemics or genetically modified organisms that disrupt natural ecosystems.

For security events, these can be related to.

- Nuclear Warfare: The potential for global fallout and long-lasting environmental damage poses threats not just to human life but to the planet's ecosystems.
- Geopolitical Conflicts and Terrorism: Regional conflicts could escalate into global wars and acts of terrorism using weapons of mass destruction present their own set of existential threats.

The recent call for academic institutions to distance themselves from the fossil fuel sector because of its role in the climate crisis therefore raises a complex ethical question about the boundaries of research collaborations. This precedent driven by environmental concerns, prompts consideration of its potential application to other sectors. For example, as AI brings its own set of existential risks, there might be a demand to cut ties with the AI technology sector. Moreover, many academic endeavours are linked with defence agencies and industry involved in geopolitics. Should collaborations with such entities also face scrutiny? Arguably, there are existential and systemic risks to humanity in various industries, so should we expect further calls for dissociation between academia and other industries? Should we expect academics not to collaborate with industries linked to systemic and existential risks? While these dissociations are rooted in ethics, they could lead to negative consequences such as reduced research funding, knowledge isolation, and missed opportunities for academia to guide industries toward ethical and sustainable practices. Additionally, universities engage in societal debates, and interactions with various industries enhance the capabilities of safety and security academics, enabling them to make more compelling arguments. Ultimately, systematically excluding certain stakeholders may limit our collective ability to comprehensively address systemic and existential risks. Engaging with a diverse array of stakeholders enriches our understanding and equips us with multifaceted strategies, which are essential for tackling profound challenges.

5. Risk of "greenwashing" is not exclusive to the fossil fuel industry

A notable concern in academic debates about severing ties with the fossil fuel industry is the risk of "greenwashing" - deceptive practices in which organizations, especially those with significant environmental footprints, present their products, policies, or initiatives as environmentally friendly or aligned with sustainability goals, even when they are not. For instance, a company might market a new system as "energy-efficient" when it only marginally reduces energy consumption compared to its predecessors. While the fossil fuel industry is a prime example, sometimes portraying harmful practices as environmentally benign, this deceptive trend is not exclusive to them. Take, for instance, the automobile manufacturing sector. Car manufacturers, in collaboration with research institutions, frequently tout advancements in vehicular safety, often emphasizing the development of "the safest car" as part of their commitment to a "Vision Zero." These claims, backed by research collaborations with many research institutions, focus on attributes such as advanced braking systems, collision warnings, and autonomous driving features. However, beneath this focus on safety lies a broader, often overlooked issue: the need to reduce car dependency altogether. While producing safer cars is commendable, the bigger picture points to the decreasing necessity of individual vehicles in urban environments, where long-term sustainability demands fewer cars, not just safer or greener ones (Martínez-Buelvas et al., 2022). The emphasis should ideally shift to promoting public transportation as a primary mode of commute. Not only is public transport generally safer when considering accident rates per capita, but it is also a more sustainable and environmentally friendly option, reducing the carbon footprint and alleviating urban congestion (World Health Organization, 2012). Moreover, the industry's promotion of electric vehicles can amount to greenwashing, as it often masks deeper issues tied to car dependence and unsustainable mobility systems.

The electrification of vehicles has generated a significant international demand for lithium, leading to increased mineral extraction. Lithium mining primarily occurs in regions typically inhabited by indigenous and rural communities in low- and middle-income countries. This exploitation of lithium has created various socio-environmental pressures, including the over-exploitation of water resources, deforestation, environmental pollution, and unsafe mining practices that have resulted in fatalities (Carr-Wilson et al., 2024; Jerez et al., 2021). The electrification process has also raised concerns about child labour in some parts of the world. For example, cobalt, a key mineral used in electrification technologies, is often mined by child laborers in the Democratic Republic of Congo (DRC) (Faber et al., 2017). Furthermore, there are growing concerns that the available resources of minerals like lithium and cobalt may not be sufficient or sustainable to support the transformation of the world's combustion engine vehicles into electric vehicles (EVs) (Seck et al., 2022; Zheng et al., 2025). Greenwashing distracts from the serious environmental and social problems linked to electrification, hiding the fact that it often creates new sustainability challenges instead of solving them.

Greenwashing, in many cases, has served to narrow industries' focus on incremental improvements. This has sidelining transformative changes that are essential to meet climate goals and uphold social and ecological justice. One clear example of this failure is the Volkswagen emissions scandal, which serves as a striking illustration of such malpractices. Faced with the challenge of legitimately enhancing the environmental performance of their diesel vehicles, Volkswagen instead resorted to employing software that manipulated emissions testing. This software was designed to hide emissions significantly exceeding legal limits, while the company marketed the product as environmentally friendly due to its supposedly low emissions (Ewing, 2017; Siano et al., 2017). Likewise, in the

agricultural sector, throughout the 20th and into the 21st century, it heavily depended on chemical pesticides to boost crop yields and manage pests. Advances in pesticides led to more efficient and targeted chemicals, for instance, glyphosate, that was said to reduce usage and environmental impacts. Yet, this has not led to reduced usage and continued focusing on such chemical solutions to support a pesticide-dependent agricultural system, overlooking more transformative, sustainable pest management methods that could greatly benefit ecosystem health. For the academic and research community, this emphasizes the importance of maintaining a long-term research focus to promote sustainability. Collaborations with industries should not solely address immediate challenges but should also envision and work towards long-term, sustainable solutions aligned with global safety, security, and environmental goals.

To effectively address these challenges, a comprehensive re-evaluation of existing collaboration and funding structures is essential. First and foremost, there's an urgent need to implement transparent disclosure mechanisms that clearly outline the sources of research funding and potential conflicts of interest. These mechanisms ensure that researchers and institutions remain accountable and transparent in their collaborations with industry partners. Additionally, the establishment of independent review panels, composed of experts devoid of vested interests, can provide invaluable oversight to evaluate the validity and integrity of collaborative research outcomes. These panels serve as a safeguard against any undue influence that may compromise the integrity of research findings. Furthermore, academic institutions must strengthen their ethical foundations. These sessions should emphasize the significance of conducting unbiased and independent research while also highlighting the potential pitfalls associated with undue industry influence. By reinforcing these ethical principles, academia can better prepare researchers to navigate the complexities of collaborative research. It is equally important for academia to advocate for a balanced research agenda. This means ensuring that research priorities are not solely dictated by large multinational corporations with substantial financial resources. Acknowledging the needs and contributions of smaller companies is vital to creating a more inclusive and diverse research landscape. As safety and security science continues to evolve, maintaining a vigilant stance against deceptive practices like greenwashing—and similar practices such as bluewashing, where industries falsely claim to have implemented safety measures when they have not—is crucial. This vigilance is necessary to uphold the discipline's credibility and trustworthiness. By actively addressing these issues and implementing ethical safeguards, academia can foster more responsible and transparent collaborations with industry partners.

6. What 'are' ethical and sustainable practices?

Safety and security practitioners are not an isolated discipline; they should actively participate in the broader debates regarding climate risk, which is evidently a major safety and security concern. However, aiming for ethical and sustainable practices among safety and security practitioners also gives rise to several questions about what this would entail. For instance, academic institutions could cut ties with the fossil fuel industry immediately, but as described earlier in this manuscript, this would be problematic for delivering systemic safety interventions as well as potentially result in new safety and security risks. We also want to emphasize that this approach offers minimal incentive for the industry to invest in safer and more sustainable alternatives currently being developed by scientists at leading universities. This challenge is compounded by the absence of substantial research and development investments without university collaboration, as well as the lack of regulatory pressure for collaborations, as universities will be showing no interest in collaborations by pulling out. Without university collaboration, the industry can argue that they are not obligated to work with academic institutions, making it difficult for regulators to exert pressure for systemic change, and thereby reducing the leverage and mechanisms for driving ethical and sustainable transitions in the industry. As academics, we could distance ourselves from collaborating with the fossil fuel industry and thereby be 'ethical' in our current research, but this would not necessarily lead to ethical and sustainable outcomes on the long run.

This highlights the need for a careful consideration of the trade-offs involved in severing ties with the fossil fuel industry and a clear definition of what constitutes 'ethical' and 'just' practices in academic engagement with various industries. It prompts questions about the timeframe we are considering in our decision making and the ultimate goals we aim to achieve. Is it justifiable to continue collaborating with industries that may currently be viewed as 'unethical' or 'irresponsible' to acquire knowledge and insights, with the intention of eventually facilitating a radical transition (Bouchaut and Asveld, 2021)? Moreover, how do we define what is 'safer,' 'more ethical,' 'just,' and 'sustainable'? Establishing a baseline for comparison and developing effective methods to assess whether proposed alternatives genuinely improve on these criteria is essential. However, it is important to acknowledge that this assessment and comparison process is riddled with uncertainties, necessitating the establishment of dedicated research efforts to anticipate and address these complexities comprehensively (Sonck et al., 2017). For instance, the advent of electric vehicles (EV) has had an undeniable impact on the transition's timeline while creating challenges for first responders responding to EV fires (Sun et al., 2020; Park, 2013). This illustrates a trade-off regarding what to win and lose on different types of threats and risks, i.e. existential and systemic. Another example is that while solar panels might reduce existential threats, they would add risks in terms of a building's fire safety. This trade-off must be acknowledged in assessing alternatives on their potential risks that may arise during the development and implementation of them so that anticipatory measures can be developed; so that communities do not need to struggle with the challenges of lagging research and technology facing new systemic threats similar to challenges of firefighters in controlling EV fires (Liu et al., 2023) Considering the latter, this would also add to the responsibility of safety and security researchers and would require a triple-helix model. Research conducted in collaboration with industry (e.g. solar panel fabricators) and universities (safety and security researchers) could point out what safety requirements would be necessary and changes in terms of the design to increase safety. In reaction, regulation (i.e., norms for the built environment) should be adjusted so that risks are lowered.

In essence, partnering with oil-and-gas companies places academics on tricky ethical ground. In principle, researchers could use their expertise to push such firms toward genuine, measurable cuts in carbon emissions. In practice, however, such partnerships can end up polishing the companies' public image – offering an academic 'seal of approval' in return for research money, consulting fees, or

career opportunities. The crux lies in whether university knowledge changes the core of the business: investment choices, production levels, and lobbying activity. If collaboration would make each barrel of oil slightly 'cleaner' or a bit cheaper, it may backfire through the Jevons Paradox – greater efficiency would lower costs, boosts profits, and can lead to more total oil and gas being burned (Alcott, 2005). So unless agreements include strict, transparent targets – such as verified drops in Scope 1–3 emissions, firm caps on production, and timelines that match climate science – academics risk acting as agents of greenwashing rather than agents of change. In short, collaboration is only ethically defensible when it demonstrably accelerates the decline of fossil fuel use. Otherwise, it risks perpetuating the status quo under the guise of sustainability.

7. The role of restorative justice in fostering sustainable partnerships

Completely severing ties with the fossil fuel industry may not be the most suitable approach for ensuring safety and security. Effective collaboration among academia, industry, and all stakeholders is vital to guarantee safety, security, and sustainability. However, it's essential to recognize that the current call to halt collaboration between universities and the fossil fuel industry arises from the industry's unethical practices. The diminishing trust in the fossil fuel industry has resulted in calls for separation as an essential step towards addressing the urgent challenges posed by climate change. This circumstance is far from ideal. While we champion the inclusion of stakeholders from the fossil fuel industry and community members, it is equally important to involve those who are hesitant to engage with the industry, recognizing them as legitimate stakeholders. We must discover methods to reengage all parties, ensuring that the industry, communities, academia, and government can effectively collaborate on climate action and other sustainability facets.

We contend that a renewed social contract for collaboration with the fossil fuel industry is essential. One promising avenue is the application of Restorative Justice—a framework for conflict resolution that has been extended to cases of corporate harm (Aertsen, 2018). Rather than focusing on punishment, Restorative Justice emphasizes repairing relationships, acknowledging harms, and fostering inclusive dialogue among all affected parties, including victims, perpetrators, and the broader community. In the context of sustainability, this approach could support structured deliberations between academic institutions, affected frontline communities, and fossil fuel entities to co-develop safety benchmarks and transition frameworks grounded in mutual accountability and long-term harm reduction. Given the fossil fuel industry's pivotal role in energy systems, its involvement in the transition process is likely unavoidable. However, meaningful collaboration must include reparative actions and a genuine commitment to Restorative Justice principles. These could entail compensating communities disproportionately impacted by environmental degradation, designing adaptive strategies for vulnerable groups, and institutionalizing equitable decision-making processes. Restorative Justice highlights the centrality of fairness and voice in climate action, providing a normative foundation for more inclusive and trust-based governance. At the same time, implementing such a framework raises important challenges. Identifying which actors can be held accountable within the diffuse structure of global supply chains—commonly referred to as the "problem of many hands" (Van de Poel et al., 2012)—complicates questions of blame and compensation. Where does the responsibility end, and who should bear the costs of remediation? These are difficult but necessary questions if collaborative approaches are to be both ethically robust and practically effective.

Table 1
Key research areas for advancing safety and security science in the transition from fossil fuels.

Type	Specific Initiative	Explanation
Industry Influence on Research	Modelling Industry-Research Interactions	Develops a model clarifying direct and indirect industry influences on research outcomes, to understand associated risks.
	Research on Industry Interference	Investigates industry interference in safety and security science, including bluewashing, to reveal strategies for favorable outcomes.
Greenwashing and Its Impacts	Understanding Greenwashing in Risk Assessments	Creates methods for assessing greenwashing risk and its impact, addressing the lack of effective evaluation tools.
Professional Development and Conflict Resolution	Value Conflict Resolution and Education	Equips safety professionals to handle conflicts between safety and sustainability, emphasizing skill and knowledge development.
	Enhancing Reporting and Transparency	Develops frameworks for transparent reporting on research outcomes aligned with sustainability, ensuring societal goals support.
Impact Analysis and Sector Comparisons	Evaluating Socioeconomic Impact	Assesses socioeconomic impacts of academic-industry collaborations, focusing on job creation, economic growth, and community well-being.
	Comparative Analysis with Renewable Energy Sectors	Analyzes differences in collaborations between fossil fuel and renewable energy sectors, identifying best practices for future policies.
Ethical Boundaries and Cooperation Scope	Deciding the Scope of Cooperation	Clarifies the extent of cooperation with the fossil fuel industry, including the boundaries of acceptable collaboration in areas like green chemistry, hydrogen production, and ownership of renewable resources, reflecting ethical values and the wellbeing of global communities.
Defining and Allocating Responsibility for Uncertainties	Defining and allocating responsibilities for uncertain risks and risks	Redefining the notion of responsibility for acquiring knowledge and data on uncertain risks and risks and (re)evaluation of responsibility allocation to actors within the value chain.
	Setting thresholds for defining what is acceptably safe and sustainable	When uncertainties are abundant, how to define what is acceptable safe given that long-term effect may remain unknown for a significant period of time.

8. What is next?

The present manuscript discusses various facets of the evolving relationship between academia and the fossil fuel industry. While this paper addresses several dimensions of a complex and evolving issue, the debate will likely continue well beyond its publication. In parallel with ongoing discourse, the field of safety and security science should advance research efforts to build a robust evidence base for supporting the transition from fossil fuels. Based on our exploration, we have identified an absence of essential tools and methodologies in our professional toolkit to approach the considerations described in the manuscript. To advance our understanding, we have reported in Table 1 the key areas that require further research, based on the considerations outlined earlier. By engaging in research efforts in these areas, the safety and security science community can contribute meaningfully to the ongoing discourse. These research endeavours will not only bolster our understanding but also facilitate more ethical and transparent collaborations between academia and industry, ultimately working towards a safer, more sustainable future.

9. Conclusion

In this paper, we have explored the ethical and practical complexities surrounding academic collaborations with the fossil fuel industry, particularly within the context of safety and security research. By critically engaging with discourses of greenwashing, transitional risk management, and knowledge capture, we argue that severing all ties may introduce new vulnerabilities—particularly in domains where academic expertise can mitigate industrial harms. At the same time, such collaborations must be carefully bounded to avoid legitimizing business-as-usual practices or undermining public trust. We propose that ethical engagement requires clearly defined criteria, measurable sustainability outcomes, and institutional safeguards that ensure transparency and accountability. This analysis contributes to a broader understanding of how universities can navigate partnerships with high-risk sectors while maintaining their social responsibilities during the energy transition.

The relationship between academic research and the fossil fuel industry carries profound implications for both environmental safety and security. While there's a growing sentiment to distance academic research from certain industry operations, an outright severance poses its own set of complications, potentially paving the way for unforeseen challenges and amplified risks. Collaborative initiatives are pivotal, offering a systems-based approach that addresses evolving threats, such as innovative green hydrogen production or the sheer scale of our complex and interconnected society, through the lens of mutual knowledge. This mutualistic approach ensures that academia remains at the forefront, shaping industry practices, while also gleaning vital insights from the practical experiences of the industry. This synergy promises more comprehensive systemic solutions and a safe and more secure future. However, advocating for a total disconnection from these stakeholders oversimplifies a multifaceted issue and may lead to the exact opposite of the envisioned goal, that is, a sustainable, safe and secure, and responsible industry. Central to the challenges is a disjunction within the system, where various factions might function in isolation rather than in collaborative harmony. Merely tackling surface issues without delving into systemic root causes might yield temporary fixes but miss addressing deeper concerns. The core challenge lies not merely in individual collaborations, but in reshaping the structural conditions that govern them. As such, attention must shift toward building robust governance mechanisms and restorative justice frameworks. These structures can guide academia and industry toward forms of engagement that safeguard research integrity while aligning with long-term sustainability goals. By situating academic collaboration within a framework of safety, ethics, and restorative justice, this paper outlines a pathway for addressing the climate crisis without compromising institutional responsibility and accountability.

CRediT authorship contribution statement

Oscar Oviedo-Trespalacios: Writing – review & editing, Writing – original draft, Project administration, Methodology, Investigation, Conceptualization. **Britte Bouchaut:** Writing – original draft. **Karolien van Nunen:** Writing – original draft. **Amir Pooyan Afghari:** Writing – review & editing. **Ming Yang:** Writing – review & editing. **Rioshar Yarveisy:** Writing – review & editing. **Eleonora Papadimitriou:** Writing – review & editing. **Perla Marang-van de Mheen:** Writing – original draft. **Pieter van Gelder:** Writing – review & editing, Writing – original draft. **Genserik Reniers:** Writing – original draft, Supervision.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

No data was used for the research described in the article.

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