



ARTICLES

Piotr GABRIELCZAK , Mariusz E. SOKOŁOWICZ 

IS ERASMUS GOING GREEN? THE CARBON FOOTPRINT OF EUROPEAN ACADEMIC MOBILITY AND SUSTAINABILITY POLICIES OF EUROPEAN UNIVERSITIES

Abstract. The European Union has promoted academic mobility for almost half a century. A side effect of that has been a growing carbon footprint, as most academic mobility in Europe is done by air. Based on mobility data for 2014–2020, we analysed its spatial distribution and identified dominant destinations. Juxtaposing these results with research on higher education institutions' environmental measures and policies, we have identified that the willingness to reduce the carbon footprint is emerging yet tenuous, and more declarative than actual. We recommend more decisive steps to reduce air travel within Europe, outlining the possibilities for carbon footprint reduction without harming European academic mobility itself.

Key words: academic mobility, carbon footprint, Erasmus.

* Piotr GABRIELCZAK, University of Lodz, Faculty of Economics and Sociology, Department of Macroeconomics, POW 3/5, 90-255 Łódź, Poland; e-mail: piotr.gabrielczak@uni.lodz.pl, ORCID: <https://orcid.org/0000-0002-9032-7204>

** Mariusz E. SOKOŁOWICZ, University of Lodz, Faculty of Economics and Sociology, Department of Regional Economics and Environment, POW 3/5, 90-255 Łódź, Poland; e-mail: mariusz.sokolowicz@uni.lodz.pl, ORCID: <https://orcid.org/0000-0002-0716-4345>



1. INTRODUCTION

All over the world, universities' internationalisation materialises in both staff and student mobility. Growing numbers of students decide to spend part of their studies in a foreign country, as do academic staff (Glover *et al.*, 2017; Hopkins *et al.*, 2016). However, due to macroeconomic, social, and individual contexts, this mobility varies greatly between countries, regions, and urban areas (Van Mol and Timmerman, 2014, p. 465).

In the European Union, for almost 40 years, academic mobility has been facilitated by the Erasmus program. Every year, the program sends abroad around 400,000 students, trainees, and staff to develop multilingualism, digital competencies, interpersonal skills, a sense of European citizenship, cultural awareness, and employability (European Commission, 2019). A side effect of this program is the increasing use of air travel, which results in a growing carbon footprint (CF). This poses a challenge to the academic world, which must search for a trade-off as international mobility provides both, much needed competencies and environmental concerns. Air travel generates between 2.5 and 4.9% of the greenhouse gas emissions responsible for climate change (Lee *et al.*, 2009, 2021). Growth in these emissions is expected to continue at the rate of 4.9% annually until 2026 (Airbus, 2007; cit. after Glover *et al.*, 2018, p. 757), while at the same time emission reductions arising from technological progress in the field are not expected to be effective before 2030 (Bows and Anderson, 2007). Air travel contributes to the CF of academic communities despite calls to travel less (Anglaret, 2018), which comes from the fact that academic mobility is largely ignored in their sustainability policies (Glover *et al.*, 2018; Mihail *et al.*, 2019).

Given the above, we aim to verify the magnitude of the environmental impact of Erasmus, based on data from the 2014–2020 period. The contribution of air transport to total greenhouse gas emissions is small compared to other sectors (energy production, agriculture, and other modes of transport) (Ritchie *et al.*, 2020). Within it, the contribution from academic mobility is even more modest. However, one cannot ignore the psychological impact that going abroad as part of the Erasmus program has on future social attitudes. Indeed, over 80% of Erasmus mobility include student travels, therefore, they occur at a point in life that can condition students' awareness and stimulate a more pro-environmental behavior in various aspects of their adult lives. For this reason, we claim that, given the many benefits arising from the internationalisation of the study and research process, the culture of mobility is essential. Still, it should take the aspect of CF to a broader extent. By identifying the scale of the CF resulting from movements under the Erasmus program, we attempt to answer the question of whether and to what extent the policies of higher education institutions (HEIs) in terms of greening their activities respond to academic mobility, and whether the program participants themselves

(both students and university employees) consider the decarbonisation aspect in their academic mobility decisions.

The next section provides a literature review focused on presenting the main facts about academic mobility and its role in generating and controlling CF emissions. Then we present the scope and methods of the research. Finally, we present and discuss the main findings. The final section concludes and provides policy implications.

2. LITERATURE REVIEW

Mobility seems to be a ‘commodity of the early twenty-first century’ (Cairns *et al.*, 2017, p. 170). Modern students find internationalisation as a way to benefit from being a part of the European flow of ideas and people (Cairns, 2014). Students and academics, compared to many social groups, are markedly more mobile and inclined to mobility (Sokołowicz, 2018). However, this mobility varies strongly in terms of selected directions. This refers to mobility between countries, regions, and urban areas. The directions of researchers’ mobility are neither even nor random. Researchers rather travel via “narrow and fragile networks, resembling the galleries termites build,” (Latour, 1987, p. 232). Firstly, these paths are strongly embedded socially and biographically. Secondly, decision to study abroad for a certain period also depend on macroeconomic context (Van Mol and Timmerman, 2014, p. 465).

Academic exchange remains an important driver of the contemporary quest for knowledge. Student mobility should not be considered separate from the movement of researchers. Both are mutually reinforcing (see, e.g., Maadad and Tight, 2014). Therefore, despite the fact that the main aim of academic mobility is to improve human capital it also results in increased scientific collaboration (Scelato *et al.*, 2015). Travelling to foreign academic destinations allows one to experience new environments and opinions, material and personal resources, and distinct forms of professional socialisation and institutional reputation that can help to inspire and facilitate creativity in academic performance (Meusbürger, 2009). Hence, academic mobility stimulates new thinking patterns (Törnqvist, 2004) and is, to some extent, a sign of excellence in research-related professions (Mahroum, 2000). In academia, mobility is considered more a source of prestige and development opportunities than devaluation (as in the lower segments of labour markets) (Bauder, 2015). It even becomes an element of academic habitus (Bourdieu, 1988), which is why national governments and supranational institutions incentivise it.

As a result, a growing number of policies, implemented by HEIs, countries, and international organisations, focus on internationalisation in various forms,

recognising the benefits at not only the individual but also the societal and political levels (Wit *et al.*, 2019). These include improved research results, language skills, strengthened research, learning and teaching capacity, and positive attitudes toward democracy (Crăciun, 2015). So far, however, despite spilling over into more and more countries, such activities are still prevalent in Europe (Crăciun, 2018). Over 1.5 million students from all major world regions studied in European higher education in 2021 (Eurostat, 2023). However, a significant component of this mobility in terms of numbers is the shorter journeys made by teachers and students within the Erasmus program framework, sending 400,000 students, trainees, and staff abroad yearly. The frequency of these trips prompts attention to its two interrelated consequences: differentiated spatial and environmental consequences, especially CF.

The decision to join the Erasmus program depends on three main groups of factors: (1) macro conditions, (2) personal background, which refers to both, socioeconomic status, and social networks, and (3) personal reasons, e.g., personal development, career opportunities, experiential goals, current language skills, and willingness to improve them (Van Mol and Timmerman, 2014, p. 466). The most important macro factors attracting Erasmus students are language and climate, as well as the general academic prestige of selected host country (Rodríguez González *et al.*, 2011). Personal factors are more nuanced, therefore, classifying them is challenging, yet one could conclude that student mobility is a multifaceted, competing, and often conflicting process (Holton and Finn, 2018). However, another study suggests that key individual factors responsible for selecting mobility destination include course suitability, academic reputation, job prospects, and teaching quality (Soutar and Turner, 2002).

Rodríguez González *et al.* (2011) used gravity models to emulate the overall picture of European students' mobility within Erasmus framework. They found that despite the financial support granted by the EU and other institutions, the differences in the cost of living, along with distance, were the key factors explaining Erasmus flows. Other significant determinants include educational background, the host university quality, and the language and the climate of the host country. Furthermore, the Erasmus flows seem to be biased towards Mediterranean countries, mainly due to their superior climate (Rodríguez González *et al.*, 2011, p. 427). Meanwhile, a network study by Breznik and Skrbinjek (2020) revealed the following Erasmus program mobility patterns:

- Spain, France, Germany, and Italy are the key nodes in the student mobility network,
- Spain, Switzerland, Austria, and Poland have the best relative balance of inbound and outbound mobility,
- Spain and Italy exchange the most students with each other,
- Luxemburg, Malta, and Liechtenstein have the largest numbers of mobile students compared to the size of the country's student population.

Breznik and Skrbinjek (2020) revealed three groups of countries: (1) good receivers and senders (Spain, Italy, and Germany), (2) good receivers only (Finland, Sweden, the United Kingdom, and Portugal) and (3) good senders only (Belgium and the Czech Republic). Another study showed that most flows involved students from low-income countries who travel to higher-income destinations (Macrander, 2017). However, at the same time, new secondary centres, which also attracted mobile students, were observed in Italy, Spain, Austria, Czech Republic, Belgium, Denmark, Poland, Hungary, Sweden, and Finland (Kondakci *et al.*, 2018). Spatial variations in Erasmus mobility are similar to processes observed beyond Europe where, despite globalisation, the world of science is still “spiky” (Florida, 2005; Olechnicka *et al.*, 2019). Many studies have confirmed that geographical distance decreases the likelihood of collaboration and reduces its intensity, which was displayed by declining numbers of co-publications, co-patents, and projects in collaboration (Hoekman *et al.*, 2010, 2013; Ploszaj *et al.*, 2020; Ponds, 2009).

A factor that significantly determines the increase in the possibility of academic cooperation is the accessibility of university centres via air travel (Ploszaj *et al.*, 2020). Air travel is responsible for a significant percentage of academic mobility, thus academia is a source of the CF generated by air traffic. This presents a challenge to the academic world – it aims to benefit from international collaborations, but at the same time, in particular due to its educational function, the academia needs to be aware of the environmental externalities of such practices. Hence, contemporary HEIs face a trade-off between internationalisation as a root of new inspirations and mobility as a reason for environmental concerns. This dilemma was temporarily halted by the COVID-19 pandemic (Nižetić, 2020), with a sudden stop of mobility. However, new analyses have shown that although the pandemic contributed to some modifications, it did not lead to structural changes in academic mobility patterns, especially in its scale and the means of transportation used (Ferencz and Rumbley, 2022; Rumbley, 2020). Air travel generates between 3.5% and 4.9% of the greenhouse gas emissions that are responsible for climate change (Lee *et al.*, 2009). Growth in these emissions is expected to continue at the annual rate of 4.9% until 2026 (Airbus, 2007; cit. after Glover *et al.*, 2018, p. 757), while CF reductions arising from technological progress in air transportation industry are not expected to become effective before 2030 (Bows and Anderson, 2007).

Academic mobility is largely ignored in sustainability policies – most HEIs are not ready for any sacrifices in that field, because mobility is an integral aspect of the academic career, growing in importance (Glover *et al.*, 2018, p. 768). Without denormalisation of this practice, any significant changes in this matter are difficult to foresee. In consequence, air travel still contributes substantially to the CF of academic communities despite repeated calls to travel less (Anglaret, 2018). The overall levels of carbon dioxide emissions

from the transport sector in the 35 European countries increased substantially between 1994 and 2014. However, 2008 was a turning point for the developed world. Following the global financial crisis, the total amount of CO₂ emissions from transport in the EU and the US entered a decreasing trend. For the US this proved to be temporary, but in the EU the trend was more sustainable, indicating that decreasing CO₂ emissions are possible. This refers both to relative (per capita and per unit of GDP) and absolute (tons) terms (Mihail *et al.*, 2019, p. 691). A surprising insight comes from Wynes *et al.* (2019) who focused on the relationship between academic performance and frequency of air travel. They noticed that frequency of travelling by air had no impact on academic performance, but instead was simply typical for older researchers and those with higher positions, which indicated that it was rather associated with habits and status. Surprisingly, Wynes *et al.* also noticed that scholars specializing in “green” related topics did not tend to travel by air significantly less than others, which also proves that there is room for implementation of awareness into action.

A drastic reduction of academic mobility is hard to imagine. A possibility of such a reduction would even be unfavourable due to the growing need for scientific collaboration. Therefore, in the nearest future the academia is most likely to adopt an “avoid-mitigate-compensate” approach (Jean and Wymant, 2019). The first step in minimising the CF is, undoubtedly, realising its scale. Thus, a sound diagnosis of European HEIs is a starting point for further measures.

3. MATERIALS AND METHODS

In order to measure the impact of European academic mobility on the CF generated and examine the response to it in actual individual and organisational actions, we conducted a three-component study. The first component involved estimating the carbon footprint scale over the 2014–2020 period of the Erasmus program. The second was contextual and it assumed the form of an exploratory survey conducted among European academic institutions. It aimed at investigating the declared responses to the environmental impact of academia and the possible countermeasures taken against the generation of a carbon footprint. The third component was qualitative and it included focus group interviews (FGI) held among the community of the HEIs involved in one of the Erasmus+ Projects (European Commission, 2022).

The first part of the research analysed the general outcome of individual mobility. The data informed us about the distance covered by each trip, although

there was no indication of the means of transport in available reporting. Thus, we assumed that all trips posited at over 600 km were airborne, while for shorter distances, coaches were more popular than trains. We utilised the estimations of Hill *et al.* (2020) for the average CF per passenger-km for a trip taken by coach or plane, following their distinction between short-haul and long-haul flights¹. We then used these conversion factors (Table 1) to estimate the total CF of the Erasmus+ program in 2014–2020.

Table 1. Conversion factors

Means of transport	CF emission (CO ₂ eq. kg/pas.km)	Range (km)
Coach	0.02732	(0;600]
Short-haul plane	0.07610	(600;1700]
Long-haul plane	0.09340	Above 1700

Source: Hill *et al.* (2020).

We have complemented the calculations through a survey in which we asked whether CF reduction activities are part of broader and deliberate European HEI policies. In order to do this, we asked whether carbon footprint reduction activities were part of broader European HEIs actions. We investigated to what extent these activities were incidental and selective, and to what extent they were part of a deliberate and structured environmental action agenda. For this purpose, we conducted Computer Assisted Web Interviews (between 22 March 2021 and 28 May 2021) to authorities and administrative bodies of European HEIs that participated in the Erasmus program. The institutions were asked about the frequency with which they undertook specific measures in waste management, energy consumption, green public procurement, grid- and rainwater management, and campus greening. We also asked about the introduction of “green” curricula and how they influenced staff and students’ transport behaviour. We reached a sample size of 68; however, after data validation, we analysed a final number of 59 responses.

Finally, we performed FGI in three universities engaged in one of the Erasmus+ Projects (European Commission, 2022), namely Erasmus University of Rotterdam, Netherlands (EUR), Lapland University of Applied Sciences, Finland (LUAS), and University of Lodz, Poland (UL). These three universities were also significant sending institutions in the 2014–2020 edition of the Erasmus+

¹ We also performed alternative calculations based on Loyarte-López *et al.* (2020). The CF calculated with alternative conversion factors was in general slightly higher, but not substantially different.

program. UL was the 78th largest contributor (almost 4,500 trips), EUR ranked 118th (almost 3,500 trips) and LUAS ranked 537th (about 1,200 trips) among 12,860 classified sending HEIs. The FGI group at EUR consisted of 9 people (7 students and 2 administrative staff members), the group at LUAS consisted of 5 people (3 students, 1 academic teacher, and 1 member of administrative staff), while the group at UL consisted of 8 people (5 students, 1 academic teacher, and 2 members of administrative staff). We performed the FGIs according to structured scenarios to provide comparative material. Firstly, we introduced the interviewees to the scale of the CF caused by academic mobility (to outline the discussion's context). Subsequently, we discussed the various instruments of its reduction (informational and promotional, aimed at raising awareness, financial, organizational, and administrative restrictions), evaluating their effectiveness and comparing them in a mutual discussion. Finally, we discussed the popularity and effectiveness of offsetting programs.

4. RESULTS

Our database indicates almost 1.9 million conducted travels within the Erasmus framework in the 2014–2020 period, more than 80% of which were student trips and only less than one in five were executed by a staff member. According to our calculations, the average distance travelled by a student was 1,375 km and 1,755 km by a member of the academic staff. Despite the large dispersion of individual distances covered, the vast majority of mobility was by air – our distance-based approximation estimates this share at just below 83%, which is consistent with the estimate of 77% obtained based on a previous survey (ESN, 2020). As much as short or long-haul flights are defined and one could relate to a previously used standard, there is no comprehensive study about the distances covered by trains or coaches. Furthermore, in the 2014–2020 financial perspective the European Commission did not gather reliable information about transportation. This will be improved for the 2021–2027 perspective, however, for the 2014–2020 dataset, the modes of transport could not be recorded and had to be assumed. Our distance-based approximation proved to be relatively well fit as it generated a share of flights similar to that based on survey results. Moreover, we decided to focus entirely on coaches and exclude trains because of two reasons. Firstly, the existing national railway networks still function in highly regulated national markets, making their international supply sparse and dispersed (Martí-Henneberg, 2013), so we believe that coaches are in fact more common. Secondly, coaches generate more CF and from a risk-assessing perspective overestimation of the CF is more desired than underestimation.

We observed three key issues concerning CF emission of the Erasmus+ edition in 2014–2020 (Fig. 1). First, there is a strong seasonality, with peaks in September, January, and February, as well as June, corresponding to the beginning and end of semesters in most HEIs in Europe. The second observation is the steady growth trend from 2014 up to mid-2018. The third finding is that the trend wavered in late 2018, only to collapse at the end of 2019.

Compared to the total CF emission in Europe (Friedlingstein *et al.*, 2021), the Erasmus+ emission (own calculation) may seem small, but it grew from 0.0006% in 2014 to 0.0017% in 2018, only to drop again in 2019 and 2020 (due to the restrictions of the COVID-19 pandemic)². The relative contribution of the Erasmus program to the total CF grew almost three times, showing that academic mobility fails to follow the global trends of emission mitigation. All in all, we estimate that in the entire 2014–2020 period the Erasmus program was responsible for emitting between 413 and 666 million tons of CO₂ equivalent. About 98% of that came from air travel – the share of contribution of CF is larger than share of flights as such, because air travel has higher unit emissions and is usually associated with longer trips (Table 1).

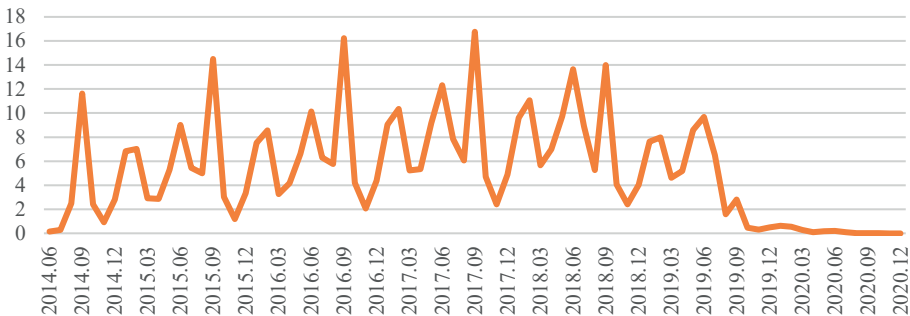


Fig. 1. CF emission of the Erasmus+ program, 2014–2020, thousands of CO₂ eq. tons

Source: own work based on data from FRSE.

The drop at the turns of 2019 and 2020 was probably due to the COVID-19 pandemic and the resulting restrictions in mobility. A more puzzling question is why the intensity of travel declined in late 2018. Our research did not provide a clear explanation. One possibility could be associated with the “yellow vest” protests in France, which is one of the key nodes within the Erasmus network. In fact, Spain, France, and Italy, along with Finland, the Baltic States, and Romania, are the largest contributors to the Erasmus travel patterns – both as sending and receiving countries (Fig. 2).

² Detailed data is available upon request.

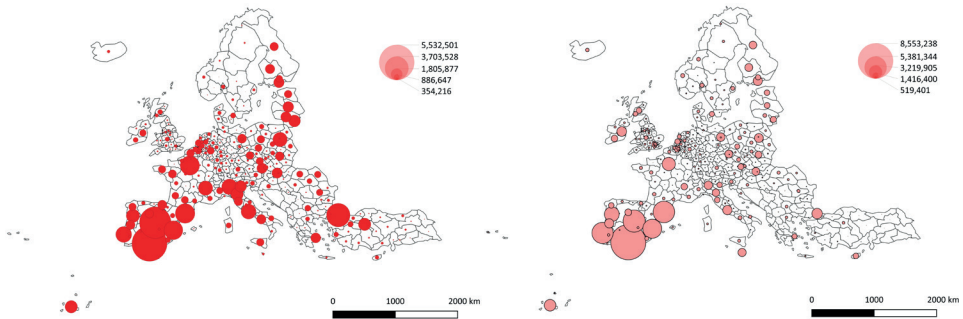


Fig. 2. Erasmus+ CF by regions (NUTS 2), aggregated 2014–2020, CO₂ eq. tons
The sending regions (left-hand panel) and the hosting regions (right-hand panel) were grouped using Jenk's classification method, which is a data-driven clustering algorithm

Source: own work based on data from FRSE.

The strong regional concentration demonstrates that the CF emission within the Erasmus+ program is granular and there are a few mobility hubs, thus sometimes even a single HEI may have a significant effect on a general scale. An increasing number of HEIs declare that they are trying to be more sustainable, but the question remains whether these actions are systemic and complex (Velazquez *et al.*, 2006). Research in the area of the academia's commitment to sustainable development is sporadic, and the findings show that, despite the efforts made and the HEIs' awareness of the need for this transformation, the transition is slow (Marrone *et al.*, 2018; Mazon *et al.*, 2020).

As demonstrated by the results of our survey, it is no different for the HEIs that are active in the Erasmus+ program. Their main measures for building a sustainable university were waste management, a standard recycling system (due to the alignment of European law in this matter), usage of recycled materials, and monitoring energy consumption. More systemic actions are declared infrequently. For example, the systemic inclusion of closed water circuits and rainwater management, the introduction of codes of good practices, or the obligatory inclusion of sustainability-related courses in curricula are more in the middle than at the top of the indications (Fig. 3).

From a transport behaviour perspective, tangible measures towards sustainable transport still seem to be an exception rather than the rule, although there are important manifestations of positive actions. To start with, 20 HEIs have declared that they utilize mobility strategies very often or often, making it the most commonly used transport-related measure. However, it ranks somewhat distantly compared to other measures. Additionally, 9 HEIs declared reimbursement of the costs of business trips based on their CF. These were the only two relatively commonly used measures directly associated with international mobilities.



Fig. 3. Measures declared by HEIs for the benefit of the environment

Source: own work.

In terms of generally transport-related policies, it is pleasing that 12 out of the 59 HEIs surveyed have their own bicycle rental systems. It is also worth noting that a relatively large number of HEIs support their employees fully or partially in the use of public transport. However, HEIs subsidise students in this respect to a much lower extent. From the perspective of the CF of academic mobility, it is particularly worrying that measures to minimise it are very rarely or almost never declared. Although some universities indicate that they implement CF calculators, they do little to eliminate that footprint at the source.

Our final research step was performing focus group interviews with people engaged in the Erasmus program – students, teachers, and administrative staff. The FGI scenario was focused on academic policies that already were or could be implemented in order to make Erasmus and general mobilities greener. We concentrated on two main problems associated with limiting the carbon footprint of the Erasmus program: emission reduction and offsetting. Moreover, we not only discussed existing types of policies, but also stimulated our participants to propose original solutions, which would be suitable for a relatively large public university.

When asked about the mitigation of negative ecological impacts of the Erasmus program, participants naturally focused on emission reduction, while the issues of offsetting had to be suggested by moderators. At first, the discussions gravitated around the problem of raising awareness about the importance of making academic travel greener. However, all the groups noticed that awareness itself may not transfer to actual behavioural change if not supported by other incentives, especially that engagement in green travel is often limited by difficulties in arranging an eco-friendly trip. Organising a flight is relatively easy, so it becomes a more and more tempting alternative if green travel becomes more challenging. Thanks to well-developed customer services, air transport is much more user friendly and skills required to schedule, e.g., a railway trip are by far less common. Moreover, staff members added that in some case they felt the organisational pressure to make travel quick and cheap, which naturally forced them to select air travel.

In all groups there was a consensus that awareness was not enough without financial instruments to promote green travel. Naturally, there was no doubt that financial incentives, such as additional support for people who select low-emission transportation modes, were a desired form of encouraging the academic society to reduce emissions. Surprisingly though, there was also a general agreement that financial disincentives, such as fees for excessive emission, were controversial, unfair, and should not be used in order to promote green attitudes. Ecological issues should not be promoted with negative connotations if they are to be widely accepted.

Interestingly, though, the FGIs participants tended not to take their individual perspective on CF reduction, but instead they rather switched to the perspective of the institution in which they worked or studied. This led them to a constatation that, despite the need for positive stimulation, some compulsion was also necessary and basic rules about emission reduction simply needed to be forced in order to be effective. Furthermore, the importance of sufficient monitoring was stressed, as providing detailed information, especially about individual contributions, would probably create social pressure, thus motivating the academic society to enhance emissions' reduction.

When it came to proposing solutions for emission's reduction, FGI participants proved quite proactive. Some of their ideas, such as additional coverage for people selecting sustainable transportation, were actually already included under the new Erasmus framework. This is due to the fact that the groups were mostly composed of students, who lacked proper information about the new version of the Erasmus program. Still, the groups managed to suggest some novel and easy to apply ideas. One example was teaching mobility students how to ride a bicycle (if necessary) and how to use bicycle routes and city bicycles at their destinations. Another idea was to organise holidays for mobility students, so that, e.g., they would stay in the host country for the winter break rather than travel back and forth in a short time. One more idea focused on utilising ecological activities in

the educational curriculum, e.g., providing additional credits. This last idea is an example for a very simple offsetting, which was the main theme for the second part of the FGI scenario.

Offsetting carbon footprint was not very popular among the respondents. Participants at LUAS claimed that none of them have used offsetting, though they would like to if only they had better knowledge on how to use it and more accessible offsetting plans. Participants at UL also had very limited knowledge of any offsetting schemes that could be implemented in order to facilitate the Erasmus program. At EUR only one participant claimed to have used offsetting in the past, but it was stressed that it was more of a way to make oneself feel better than an effective way to deal with carbon footprint. In fact, in all the groups it has been noticed that offsetting was non-pedagogical, because it promoted absolution rather than mitigation of emission. As stressed by one of the participants at EUR, carbon neutrality was a “false claim” because it could be done at relatively significant levels of current pollution, so neutrality without emission reduction was not sustainable. This suggests that offsetting should be used only when options for avoiding or reducing CF were implemented at first.

Moreover, as it requires undertaking further actions independent from the travel itself, it also generates costs. It would only make sense if HEIs had detailed long-term plans for offsetting which are typically missing. Such plans are associated with two types of barriers in implementation. Firstly, they should be supported by some kind of an offsetting fund that would be fed whenever members of the academic community select high-emission transport, but this would be a financial disincentive (or negative incentive), which is generally considered undesired. At LUAS it has been stressed that such additional costs would be especially harmful if applied towards students.

Secondly, offsetting is effective only on a large scale and participants tended to criticize it as ineffective because it could bring results only after too long a period. This last remark may be associated with the fact that forestation and investing in renewable energy sources were the only forms of offsetting that were noticed by all the participants. However, as one of the participants at UL noticed, providing a catalogue of potential offsetting activities and allowing students or staff members to choose which offsetting would be supported in reference to their own carbon footprint would probably increase interest in that kind of activities. It could also be organised in a form of citizen budget, where members of the academic community could vote for an initiative supported, e.g., during the forthcoming academic year. Both ideas focus on the idea of choice. All the FGI participants agreed that offsetting as such should be mandatory, if it was to be effective, but a particular form of offsetting should not be imposed. Giving the right to choose the offsetting project makes academic travellers more engaged and devoted, which is in line with the self-determination theory of education (Brooks and Young, 2011).

5. DISCUSSION AND CONCLUSION

A drastic reduction in the mobility of students and researchers is hard to imagine. Such a reduction would even be undesired from the perspective of the increasing need for scientific collaboration. Therefore, adopting an “avoid-mitigate-compensate” approach (Jean and Wymant, 2019) seems to be the most likely strategy for academic communities in the coming years. The first important step in minimising the CF is measuring its scale and regular monitoring. Thus, a sound diagnosis of European HEIs as CF producers is a starting point for further actions. Linking the scale of CO₂ emissions to travel funding should be the next step, but our survey proves it to be one of the least frequently indicated measures. Admittedly, the surveyed HEIs increasingly display a pro sustainability attitude. Still, the pace remains unsatisfactory, especially regarding more direct support of students and employees in changing their transport behaviours towards greener ones. This is in line with previous research findings that HEIs are in reality relatively active in their attempts to reduce carbon emissions, but this is still not enough and more is expected from them.

Another conclusion from our research is that emission reduction and offsetting require proper institutional nesting. To start with, these issues need to be comprehensively organised in long-term strategies planned on a scale large enough. Moreover, there is a need to communicate that such strategies are implemented. Raising awareness is the first step to make a behavioural change, and that is possible only if the academic society is sufficiently well educated about the need for action and informed about the actions actually taken and planned for the future. Awareness should be supported by decent monitoring, positive financial incentives along with some mandatory regulations, especially in terms of offsetting, which is considered to be more controversial. All the implemented instruments should be well propagated, especially among students who seem to be the victims of information asymmetry in the academic society. There is also a need for HEIs and their partners to be more creative in designing programs for supporting sustainability. So far, when it comes to offsetting, many members of the academic world cannot imagine schemes beyond forestation and renewable energy.

New institutional solutions and organisational changes undertaken by HEIs also need some flexibility. They could be more flexible in their procedures, and each new rule or requirement makes the organisation even more rigid (Lomas, 1999). Introducing sustainable strategies in HEIs demands much flexibility due to the complexity of the matter (Blanco-Portela *et al.*, 2018), so limiting it would be counter-effective on a larger scale. However, this is only possible with actions taken on an international level, e.g., the EU. HEIs may be active actors of international mobilities, but the sustainability challenge still requires coordination and standardisation on a level where HEIs are regulation takers rather than policymakers. European Agendas must notice this circumstance.

One must also point to the still existing necessity to implement coordination and standardisation on a level exceeding the regulating capacity of HEIs. There is a significant lack of practical skills when it comes to planning a trip by means of transport alternative to air travel and this barrier cannot be reduced without an intervention on the level of international policy makers. An online tool for scheduling travel by railway or bus routes would be a desired improvement, but in order to create such a tool proper EU authorities should provide common European travel conditions and standards for these modes of transportation. This is in particular visible in terms of railway networks – as long as they remain national, the use of railway transport (probably the best alternative for aviation) in international mobility will be limited.

In the context of the research results obtained, we assume little likelihood of reduction in academic travel. We have identified a firm conviction that, without strong and consistent legal and financial regulations at the European and national levels, travel by air will dominate. The incidental decline in travel caused by the COVID-19 pandemic has not caused significant structural changes in this regard, and future predictions for the development of academic mobility in Europe assume its growth. Moreover, the development of initiatives involving the emergence of meta-organisations focused on strategic partnerships and alliances (particularly the newly launched European Universities) makes it likely that another significant type of actors will emerge, contributing to increasing the mobility of HEIs students and staff (Ferencz and Rumbley, 2022). In such a case, the development of internationalisation through remote communication will be complementary rather than substitutive to this trend. Therefore, the most feasible solution is a concerted effort to provide a transportation alternative to air transport at the European scale, primarily through trans-European railroads. “Europe stands out as a region of the world that may be somewhat well-placed-by virtue of the density of countries in a relatively small geographic region and highly developed public transportation systems relative to many other parts of the world-to implement changes in travel patterns for academic mobility (Ferencz and Rumbley, 2022, p. 286).”

To conclude, the awareness of the importance of sustainability and its popularity as an idea is growing, but it requires a more strategic approach and more institutional support. Not only because of how crucial this issue is, but also because of the economies of scale that are very strong in that field, which means that emission reduction or successful offsetting can only be efficient when done on a large scale.

Acknowledgments. We would like to express our deepest gratitude to the Foundation for the Development of the Education System (FRSE, the Polish national Erasmus+ agency), which provided us with the data necessary to conduct the analyses. Special thanks to our co-investigators under the Erasmus Goes Green team.

Funding. Erasmus Goes Green (EGG) project, financed by the Erasmus+ Strategic Partnership (KA 203) Program; 2020-1-FR01-KA203-080260.

REFERENCES

- AIRBUS (2007), *Flying by Nature: Global Market Forecast 2007–2026*. http://dev.ulb.ac.be/%0A-ccese/ABC_Impacts/documents_abc/Global_market_forecast.pdf%0A [accessed on: 07.08.2023].
- ANGLARET, X. (2018), 'I would prefer not to aggravate global warming', *Lancet Planetary Health*, 2 (9), E382–E383. [https://doi.org/10.1016/S2542-5196\(18\)30171-2](https://doi.org/10.1016/S2542-5196(18)30171-2)
- BAUDER, H. (2015), 'The International Mobility of Academics: A Labour Market Perspective', *International Migration*, 53 (1), pp. 83–96. <https://doi.org/10.1111/j.1468-2435.2012.00783.x>
- BLANCO-PORTELA, N., R-PERTIERRA, L., BENAYAS, J. and LOZANO, R. (2018), 'Sustainability Leaders' Perceptions on the Drivers for and the Barriers to the Integration of Sustainability in Latin American Higher Education Institutions', *Sustainability*, 10 (8). <https://doi.org/10.3390/su10082954>
- BOURDIEU, P. (1988), *Homo Academicus*, Stanford University Press.
- BOWS, A. and ANDERSON, K. L. (2007), 'Policy clash: Can projected aviation growth be reconciled with the UK Government's 60% carbon-reduction target?', *Transport Policy*, 14 (2), pp. 103–110. <https://doi.org/10.1016/j.tranpol.2006.10.002>
- BREZNIK, K. and SKRBINJEK, V. (2020), 'Erasmus student mobility flows', *European Journal of Education*, 55 (1), pp. 105–117. <https://doi.org/10.1111/ejed.12379>
- BROOKS, C. F. and YOUNG, S. L. (2011), 'Are Choice-Making Opportunities Needed in the Classroom? Using Self-Determination Theory to Consider Student Motivation and Learner Empowerment', *International Journal of Teaching and Learning in Higher Education*, 23 (1), pp. 48–59. <https://files.eric.ed.gov/fulltext/EJ938578.pdf> [accessed on: 07.08.2023].
- CAIRNS, D. (2014), *Youth transitions, international student mobility and spatial reflexivity: Being mobile?*, Palgrave Macmillan.
- CAIRNS, D., CUZZOCREA, V., BRIGGS, D. and VELOSO, L. (2017), *The consequences of mobility. Reflexivity, social inequality and the reproduction of precariousness in highly qualified migration*, Palgrave Macmillan.
- CRĂCIUN, D. (2015), 'Systematizing internationalization policy in higher education: Towards a typology', *Perspectives of Innovations, Economics and Business*, 15 (1), pp. 49–56.
- CRĂCIUN, D. (2018), 'National policies for higher education internationalization: A Global Comparative Perspective', [in:] CURAJ, A., DECA, L. and PRICOPIE, R. (eds), *European Higher Education Area: The Impact of Past and Future Policies*, pp. 95–106, Springer International Publishing.
- ESN (2020), *Students' Mobility Needs. Snapshots of a Eurail survey on participants in Erasmus+ Mobility Programme*, https://esn.org/sites/default/files/news/erasmus_mobility_survey_report_-_final_0.pdf [accessed on: 07.08.2023].
- EUROPEAN COMMISSION (2019), *Erasmus+ Higher Education Impact Study*, <https://op.europa.eu/en/publication-detail/-/publication/94d97f5c-7ae2-11e9-9f05-01aa75ed71a1/language-en> [accessed on: 07.08.2023].
- EUROPEAN COMMISSION (2022), *Erasmus+ project results*. Erasmus+. EU Programme for Education, Training, Youth and Sport, <https://erasmus-plus.ec.europa.eu/projects/search/?page=1&sort=&domain=eplus2021&view=list&map=false&searchType=projects> [accessed on: 07.08.2023].
- EUROSTAT (2023), *Learning mobility statistics*, Learning Mobility Statistics, https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Learning_mobility_statistics#Students_from_abroad [accessed on: 07.08.2023].

- FERENCZ, I. and RUMBLEY, L. E. (2022), 'Europe's post-pandemic internationalisation: Challenges and possibilities in a decidedly networked future', *Higher Education Quarterly*, 76 (2), pp. 276–292. <https://doi.org/10.1111/hequ.12381>
- FLORIDA, R. (2005), 'The World Is Spiky: Globalization Has Changed the Economic Playing Field, but Hasn't Levelled It', *Atlantic Monthly*, 48.
- FRIEDLINGSTEIN, P., JONES, M. W., O'SULLIVAN, M. *et al.* (2021), 'Global Carbon Budget 2021', *Earth System Science Data Discussions*, 2021, pp. 1–191. <https://doi.org/10.5194/essd-2021-386>
- GLOVER, A., STRENGERS, Y. and LEWIS, T. (2017), 'The unsustainability of academic aeromobility in Australian universities', *Sustainability: Science, Practice, and Policy*, 13 (1), pp. 1–12. <https://doi.org/10.1080/15487733.2017.1388620>
- GLOVER, A., STRENGERS, Y. and LEWIS, T. (2018), 'Sustainability and academic air travel in Australian universities', *International Journal of Sustainability in Higher Education*, 19 (4), pp. 756–772. <https://doi.org/10.1108/IJSHE-08-2017-0129>
- GROSSETTI, M., ECKERT, D., GINGRAS, Y., JÉGOU, L., LARIVIÈRE, V. and MILARD, B. (2013), 'Cities and the geographical deconcentration of scientific activity: A multilevel analysis of publications (1987–2007)', *Urban Studies*, 51 (10), pp. 2219–2234. <https://doi.org/10.1177/0042098013506047>
- HILL, N., THISTLETHWAITE, G., BATES, J., KARAGIANNI, E., MACCARTHY, J., MULLEN, P., KELSALL, A., HINTON, S., WALKER, C. and HARRIS, B. (2020), *2020 Government greenhouse gas conversion factors for company reporting: Methodology Paper for Conversion Factors. Final Report*. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/990675/2021-ghg-conversion-factors-methodology.pdf [accessed on: 07.08.2023].
- HOEKMAN, J., FRENKEN, K. and TIJSSEN, R. J. W. (2010), 'Research collaboration at a distance: Changing spatial patterns of scientific collaboration within Europe', *Research Policy*, 39 (5), pp. 662–673. <https://doi.org/10.1016/j.respol.2010.01.012>
- HOEKMAN, J., SCHERNGELL, T., FRENKEN, K. and TIJSSEN, R. (2013), 'Acquisition of European research funds and its effect on international scientific collaboration', *Journal of Economic Geography*, 13 (1), pp. 23–52. <https://doi.org/10.1093/jeg/lbs011>
- HOLTON, M. and FINN, K. (2018), 'Being-in-motion: the everyday (gendered and classed) embodied mobilities for UK university students who commute', *Mobilities*, 13 (3), pp. 426–440. <https://doi.org/10.1080/17450101.2017.1331018>
- HOPKINS, D., HIGHAM, J., TAPP, S. and DUNCAN, T. (2016), 'Academic mobility in the Anthropocene era: a comparative study of university policy at three New Zealand institutions', *Journal of Sustainable Tourism*, 24 (3), pp. 376–397. <https://doi.org/10.1080/09669582.2015.1071383>
- JEAN, K. and WYMANT, C. (2019), 'Airborne in the era of climate change', *Science*, 363 (6424), 240 LP – 240. <https://doi.org/10.1126/science.aaw1145>
- KONDAKCI, Y., BEDENLIER, S. and ZAWACKI-RICHTER, O. (2018), 'Social network analysis of international student mobility: uncovering the rise of regional hubs', *Higher Education*, 75 (3), pp. 517–535. <https://doi.org/10.1007/s10734-017-0154-9>
- LATOUR, B. (1987). *Science in action. How to follow scientists and engineers through society* (11th ed.), Harvard University Press.
- LEE, D. S., FAHEY, D. W., FORSTER, P. M., NEWTON, P. J., WIT, R. C. N., LIM, L. L., OWEN, B. and SAUSEN, R. (2009), 'Aviation and global climate change in the 21st century', *Atmospheric Environment*, 43 (22), pp. 3520–3537. <https://doi.org/10.1016/j.atmosenv.2009.04.024>
- LEE, D. S., FAHEY, D. W., SKOWRON, A. *et al.* (2021), 'The contribution of global aviation to anthropogenic climate forcing for 2000 to 2018', *Atmospheric Environment*, 244, 117834. <https://doi.org/10.1016/j.atmosenv.2020.117834>
- LOMAS, L. (1999), 'The culture and quality of higher education institutions: examining the links', *Quality Assurance in Education*, 7 (1), pp. 30–34. <https://doi.org/10.1108/09684889910252513>

- LOYARTE-LÓPEZ, E., BARRAL, M. and MORLA, J. C. (2020), 'Methodology for Carbon Footprint Calculation Towards Sustainable Innovation in Intangible Assets', *Sustainability*, 12 (4). <https://doi.org/10.3390/su12041629>
- MAADAD, N. and TIGHT, M. (2014), *International Perspectives on Higher Education Research*, 11, Academic Mobility, Emerald Publishing Limited. <https://doi.org/10.1108/S1479-3628201411>
- MACRANDER, A. (2017), 'Fractal inequality: A social network analysis of global and regional international student mobility', *Research in Comparative and International Education*, 12 (2), pp. 243–268. <https://doi.org/10.1177/1745499917712616>
- MAHROUM, S. (2000), 'Highly skilled globetrotters: mapping the international migration of human capital', *R&D Management*, 30 (1), pp. 23–32. <https://doi.org/10.1111/1467-9310.00154>
- MARRONE, P., ORSINI, F., ASDRUBALI, F. and GUATTARI, C. (2018), 'Environmental performance of universities: Proposal for implementing campus urban morphology as an evaluation parameter in Green Metric', *Sustainable Cities and Society*, 42, pp. 226–239. <https://doi.org/10.1016/j.scs.2018.07.012>
- MARTÍ-HENNEBERG, J. (2013), 'European integration and national models for railway networks (1840–2010)', *Journal of Transport Geography*, 26, pp. 126–138. <https://doi.org/10.1016/j.jtrangeo.2012.09.004>
- MAZON, G., PEREIRA RIBEIRO, J. M., MONTENEGRO DE LIMA, C. R., CASTRO, B. C. G. and GUERRA, J. B. S. O. de A. (2020), 'The promotion of sustainable development in higher education institutions: top-down bottom-up or neither?', *International Journal of Sustainability in Higher Education*, 21 (7), pp. 1429–1450. <https://doi.org/10.1108/IJSHE-02-2020-0061>
- MEUSBURGER, P. (2009), 'Milieus of Creativity: The Role of Places, Environments, and Spatial Contexts', [in:] MEUSBURGER, P., FUNKE, J. and WUNDER, E. (eds), *Milieus of Creativity. An Interdisciplinary Approach to Spatiality of Creativity*, pp. 97–153, Springer. <https://doi.org/10.1007/978-1-4020-9877-2>
- MIHAIL, E., MIHAI, F.-C. and MUNTEANU, A.-V. (2019), 'Sustainability of the transport sector during the last 20 years: evidences from a panel of 35 countries', *19th International Multidisciplinary Scientific GeoConference SGEM*, 95491. <https://doi.org/10.5593/sgem2019/5.1>
- NIŽETIĆ, S. (2020), 'Impact of coronavirus (COVID-19) pandemic on air transport mobility, energy, and environment: A case study', *International Journal of Energy Research*, 44, 10953–10961. <https://doi.org/10.1002/er.5706>
- OLECHNICKA, A., PŁOSZAJ, A. and CELIŃSKA-JANOWICZ, D. (2019), *The Geography of Scientific Collaboration*, Routledge.
- PŁOSZAJ, A., YAN, X. and BÖRNER, K. (2020a), 'The impact of air transport availability on research collaboration: A case study of four universities', *PLOS ONE*, 15 (9), e0238360. <https://doi.org/10.1371/journal.pone.0238360>
- PŁOSZAJ, A., YAN, X. and BÖRNER, K. (2020b), 'The impact of air transport availability on research collaboration: A case study of four universities', *PLOS ONE*, 15 (9), e0238360. <https://doi.org/10.1371/journal.pone.0238360>
- PONDS, R. (2009), 'The limits to internationalization of scientific research collaboration', *The Journal of Technology Transfer*, 34 (1), pp. 76–94. <https://doi.org/10.1007/s10961-008-9083-1>
- RITCHIE, H., ROSER, M. and ROSADO, P. (2020), 'CO₂ and Greenhouse Gas Emissions', *Our World in Data*. <https://ourworldindata.org/co2-and-other-greenhouse-gas-emissions> [accessed on: 07.08.2023].
- RODRÍGUEZ GONZÁLEZ, C., BUSTILLO MESANZA, R. and MARIEL, P. (2011), 'The determinants of international student mobility flows: an empirical study on the Erasmus programme', *Higher Education*, 62 (4), pp. 413–430. <https://doi.org/10.1007/s10734-010-9396-5>
- RUMBLEY, L. E. (2020), 'Internationalization of higher education and the future of the planet', *International Higher Education*, 100, pp. 32–34.

- SCELLATO, G., FRANZONI, C. and STEPHAN, P. (2015), 'Migrant scientists and international networks', *Research Policy*, 44 (1), pp. 108–120. <https://doi.org/10.1016/j.respol.2014.07.014>
- SOKOŁOWICZ, M. E. (2018), 'Student cities or cities of graduates? The case of Lodz and its students declared preferences', *Population, Space and Place*, 25 (2), e2177.
- TÖRNQVIST, G. (2004), 'Creativity in Time and Space', *Geografiska Annaler, Series B, Human Geography*, 86 (4), pp. 227–243. <http://www.jstor.org/stable/3554349>
- VAN MOL, C. and TIMMERMAN, C. (2014), 'Should I Stay or Should I Go? An Analysis of the Determinants of Intra-European Student Mobility.', *Population, Space and Place*, 20 (5), pp. 465–479. <https://doi.org/https://doi.org/10.1002/psp.1833>
- VELAZQUEZ, L., MUNGUÍA, N., PLATT, A. and TADDEI, J. (2006), 'Sustainable university: what can be the matter?', *Journal of Cleaner Production*, 14 (9), pp. 810–819. <https://doi.org/10.1016/j.jclepro.2005.12.008>
- WIT, H. DE, RUMBLEY, L. E., CRĂCIUN, D., MIHUT, G. and WOLDEGIYORGIS, A. (2019), 'International Mapping of National Tertiary Education Internationalization Strategies and Plans (NTEISPs)', [in:] *CIHE Perspectives*, 12, Center for International Higher Education.
- WYNES, S., DONNER, S. D., TANNASON, S. and NABORS, N. (2019), 'Academic air travel has a limited influence on professional success', *Journal of Cleaner Production*, 226, pp. 959–697. <https://doi.org/10.1016/j.jclepro.2019.04.109>