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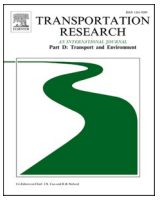

Practice what you preach? Evaluating academics' attitudes towards conference travel habits

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ABSTRACT

Today, there is growing concern over the climate impact of long-distance travel – academic conference travel included. While institutions worldwide develop sustainability policies, it remains unclear whether academics are willing to adopt such measures and change their behaviours for environmental reasons. Based on a survey of 245 Spanish academics, we identify a set of motivational factors underlying individuals' intentions towards conference travel. Using Latent-Class-Cluster-Analysis, we detect three distinct profiles: "Low-concerned academics", with limited regard for environmental concerns and social norms; "Performance-oriented academics", driven by career advancement; and "Flight-shamed academics", highly aware of environmental and social issues. Additionally, we examine perceptions of the actual, minimum, and expected number of conferences attended annually, recognising notable discrepancies. Our findings can inform targeted policies in four key areas: promoting greener choices, reshaping academic culture to normalise lower-carbon practices, raising awareness and strengthening institutional engagement, and supporting online participation.

1. Introduction

In an era marked by heightened attention to environmental sustainability and pressing concerns about climate change, greenhouse gas emissions from long-distance travel have become a central topic in global conversations (Sheller, 2022; Cats, 2025). Long-distance travel – and air travel in particular – is increasingly in conflict with the climate goals of our societies. While advocates of the aviation sector often emphasise its economic importance, highlighting its contributions to GDP growth and job creation (Button & Yuan, 2013; Njoya & Nikitas, 2020), it is equally clear that a growing reliance on air transport conflicts with several of the Sustainable Development Goals set by the United Nations (UN, 2015) and undermines a number of the commitments established in the Paris Agreement (Scott et al., 2016).

Recent studies in the fields of transport and environmental sciences estimate that air travel currently accounts for approximately 2–3 % of global carbon emissions (Larsson et al., 2019; Lee et al., 2021). Expected to rise up to 3.5 % per year, this number is projected to amount to 22 % by 2050 (Kantenbacher et al., 2018). In response, several European governments have been compelled to implement measures aimed at mitigating the negative externalities generated by this form of mobility, involving different strategies such as encouraging technological advancements, promoting the use of low-carbon energy sources, enhancing the efficiency of air traffic

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operations, and limiting travel volumes compared to baseline projections (Larsson et al., 2019).

Business, in particular, is an important driver of long-distance travel. In 2022, 9.3 % of the long-distance trips made by European residents were work-related, reflecting the extent to which flying is embedded in the operational culture of many industries (European Commission, 2023). While air travel for personal purposes is generally regarded as discretionary – typically associated with leisure activities such as weekend getaways or the pursuit of individual travel aspirations (Randles & Mander, 2009; Higham et al., 2013) – professional air travel is more often framed as a necessity, whether real or perceived.

Specifically in the academic sector, the environmental impacts generated by long-distance travel are today a growing concern (Cats et al., 2022; Tseng et al., 2022; Theeuwes et al., 2025). Academics, as members of a dynamic and interconnected network, engage in a wide range of activities that require mobility, including fieldwork, theses defences, or committee meetings (Stephenson, 2023). Notably, among these activities, conference participation stands out as a central component of an academic career, occupying a significant amount of researchers' time (Glover et al., 2018; Wenger, 2023). Conferences not only offer a valuable platform for presenting and sharing one's research with interested peers, but also support researchers in building and sustaining professional networks, fostering international collaborations, initiating new projects, enhancing academic visibility, engaging in intellectual exchange, and staying up to date with the latest developments within a discipline. In a globally competitive setting, conference attendance is widely acknowledged as both a facilitator and an indicator of academic career success (Sanders et al., 2022).

Nevertheless, despite their professional opportunities, regular travelling to conferences is a carbon-intensive practice that contributes to climate change (Neugebauer et al., 2020). As a result, conference travel appears to lead to the somewhat curious fact that academics – sometimes even those working in fields related to sustainability – tend to have a considerably higher average carbon footprint than non-academics, all else being equal (Jackle, 2022). To better understand these complexities, it seems crucial to examine not only academics' actual behaviour, but also their preferred and self-perceived minimum levels of conference participation. These three dimensions offer complementary insights: actual attendance reflects current travel habits; preferred attendance reveals individuals' aspirations and the extent to which they might be willing to modify their behaviour; and minimum attendance captures the perceived threshold required to effectively fulfil their professional responsibilities. Considering them together helps identify potential gaps between what academics currently do, what they would like to do, and what they feel they must do.

In recent years, increasing attention is being directed towards the substantial environmental effects of academics' conference travel – an issue that is gaining particular prominence at the institutional level (Glover et al., 2018; Ahonen & Rask, 2024; De Vos et al., 2024; Wenger et al., 2025). The ongoing debate – primarily centred on the responsibility of academics to reduce their mobility in order to align their actions with their sustainability discourse and to serve as role models for the broader public (Shields, 2019; Wynes et al., 2019; Neugebauer et al., 2020; Whitmarsh et al., 2020) – has, in turn, prompted a call for the adoption of more sustainable conference management practices (Young, 2009; Draper et al., 2011). Notably, numerous universities and research institutes around the world have recently committed to net-zero targets, introducing a range of sustainability policies that explicitly include measures to limit the number of events that individuals physically attend each year (Bauer et al., 2021; Latter & Capstick, 2021). However, the implementation of such initiatives remains uneven: while some institutions have taken significant steps to support low-emission alternatives, others provide minimal guidance in this regard (Schrems & Upham, 2020; Theeuwes et al., 2025).

In addition to environmental considerations, other factors at the institutional level, such as career advancement prospects and access to financial support, play a pivotal role in influencing academics' travel decisions (Storme et al., 2013; Le Quéré et al., 2015). For instance, many institutions continue to regard in-person conference participation as a key aspect in one's professional development, reinforcing the perception that frequent travel is essential for academic success. Moreover, the availability of funding, or the lack thereof, tend to influence researchers' ability to attend such events.

Within this framework, a couple of studies conclude that, in the short term, behavioural change interventions represent the most practical and effective means of enabling academics to decrease the carbon footprint associated with conference travel (Jacobson et al., 2020; Kreil, 2021). Nevertheless, even if such initiatives are deployed to encourage more sustainable practices, it is still unclear whether individuals are willing to accept and adopt them, and thereby ultimately modify their work-related habits (Schrems & Upham, 2020). As noted by different authors (e.g., Whitmarsh et al., 2020; Chiambaretto et al., 2021), understanding the motivations behind academics' conference travel is key in shaping "green" policies that are capable of influencing individual decision making, instigating a transition of academic behaviours towards more environmentally friendly routines.

This research therefore aims to identify attitudinal motivations underlying conference travel among academics, and how these may vary across them. We conduct a survey in Spain with the objective of identifying latent clusters of individuals with similar preferences and expectations. We then characterise the different groups according to a set of socio-demographic and work-related attributes, as well as their perspectives on conference travel habits. Finally, building on these insights, we propose a series of policy recommendations tailored to each of the clusters detected to encourage more sustainable practices within the academic community. This can help institutions design more effective, context-sensitive strategies. It should be noted that the sample is concentrated in the transport discipline, which should be considered when interpreting the findings.

The remainder of this article is organised as follows. After this introductory chapter, Section 2 explores the attitudes towards long-distance travel, with a focus on academics. Section 3 then describes the methodology, including the data collection procedure and the subsequent modelling approach. Next, Section 4 presents the results and Section 5 discusses them. Finally, Section 6 provides the conclusions, including study limitations and directions for further research.

2. Literature review: motivations related to conference travel

Much attention has been devoted in the literature to exploring the motivations behind long-distance travel, with a primary focus on

aviation for leisure and tourism (Mokhtarian et al., 2015; Ullman & Aultman-Hall, 2020). In contrast, there is comparatively limited understanding of the factors that drive travel in professional contexts – such as meetings, conferences, and exhibitions. With the continued global expansion of business activities, international business travellers now represent an increasingly significant segment of the travel market (Wang & Beise-Zee, 2013; Cazanova et al., 2014). Given the scale of this mobility and its role in fostering innovation (Hovhannisyan & Keller, 2015), further investigation is merited.

Within this wide spectrum of business travel, we hereby focus on the academic sector and, more specifically, on conference attendance. Travelling to these events depends on personal characteristics (e.g., gender, age, academic discipline, source country), but also on psychological factors such as enjoyment, environmental awareness, and ethical responsibility (Steg & Vlek, 2009). As pointed out by Kreil (2021), exploring these latter attitudinal attributes is key to understanding academics' behaviour and identifying opportunities to encourage changes in their habits.

The ongoing globalisation of academia intensifies the need for academics to establish connections around the world (Høyer & Naess, 2001). As a consequence, mobility becomes a fundamental component of research careers across scientific disciplines, playing a pivotal role in the academic labour market (Fontes et al., 2013). Academics frequently perceive professional travel as advantageous not only for the broader academic community but also for their own development (McInroy et al., 2018). Previous work specifically highlights the relevance of networking and social motivations associated with conference travel. This practice is expected to enable researchers to create and consolidate connections, fostering a sense of professional belonging, which can bring benefits to both individuals and the institutions they represent (Fontes et al., 2013).

At the same time, advances in Information and Communication Technologies (ICTs) create the possibility to replace – or, at least, complement – face-to-face interactions with virtual communication (Lassen et al., 2006; Higham et al., 2019). These technologies offer a range of advantages, including a reduced environmental footprint by minimising travel, increased accessibility for a wider range of individuals, and significant cost savings associated with travel expenses, among others (Moss et al., 2021). As a result, some institutions now promote online activities as a "greener" and more inclusive alternative to traditional in-person gatherings, particularly benefiting academics who face financial limitations, geographical restrictions, visa-related constraints, or caregiving responsibilities. In this context, virtual conferences are increasingly positioned as a sustainable model with social, environmental, and economics gains (Tao et al., 2021). These digital practices were further accelerated by the COVID-19 pandemic, which triggered an unprecedented disruption of travel patterns that extended beyond the health crisis itself (Sheller, 2022) and introduced new habits and expectations. Among the main changes in professional mobility dynamics, experts highlight the widespread adoption of teleworking (Athanasiadou & Theriou, 2021; Widar et al., 2022; Wöhner, 2022; Lopez-Soler et al., 2023).

Nevertheless, there are indications that, even with the progress of ICTs, in-person contact – largely facilitated by long-distance travel – continues to be the prevailing mode of academic engagement (Wenger, 2022). While digital work platforms offer new avenues, several individuals note that building trust and confidence through these tools can be challenging. Face-to-face interaction plays a crucial role in academia, especially in informal settings where networking occurs organically, such as during spontaneous hallway conversations or unplanned exchanges over coffee (Lassen et al., 2006; Storme et al., 2017; Foramitti et al., 2021). This importance extends to academic conferences, where casual discussions on the sidelines frequently outweigh formal proceedings. Furthermore, logistical barriers – such as technical difficulties, screen fatigue, and time-zone differences – can hinder participation and reduce the overall effectiveness of virtual collaboration (Moss et al., 2021; Tao et al., 2021).

By now, many academics have experienced both the advantages and drawbacks of virtual formats. Research suggests that virtual participation has not supplanted the need for physical proximity in academia (Simon et al., 2018; Jackle, 2022); rather, the two models are often "juggled to meet conflicting obligations of presence" (Storme et al., 2017, p. 16). This hybrid approach seems to allow academics to make more strategic decisions about when and how to travel. Looking ahead, emerging technologies – such as immersive virtual environments, networking tools powered by Artificial Intelligence (AI), and enhanced virtual reality (VR) – may help address some of the perceived limitations of virtual interaction in the future. However, the extent to which these innovations can truly replicate in-person exchanges remains uncertain, as does the willingness of the academic community to fully embrace them (Seidenberg et al., 2021; Wenger, 2023).

At the individual level, many researchers point out that travelling is not always pleasant and enjoyable, but necessary for the sake of their professional development (Cohen et al., 2020; Eriksson et al., 2020). They argue that reducing their trips could negatively impact their career performance and reputation, particularly for those working in remote or less connected locations (Larner, 2015). Up to now, while empirical evidence remains elusive, numerous academics perceive that their international experience and mobility could be closely linked to achieving success and garnering prestige. Critics, however, argue that academia could operate efficiently with reduced travel (Le Quéré et al., 2015), allowing individuals more time to focus on their various research and educational responsibilities.

It is also key to note that current patterns of conference travel are increasingly being challenged by an evolving social norm that advocates for a reduction in long-distance travel within academia (Le Quéré et al., 2015). Some scholars argue that academics should limit their mobility to serve as role models and align their behaviours with the sustainability principles they promote (Nathans & Sterling, 2016). Within this framework, highly aero-mobile academics now risk facing accusations of hypocrisy due to the inconsistency between their actions and the ecological values underpinning their work (Higham & Font, 2020). Conversely, other scholars (Eriksson et al., 2020; Schrems & Upham, 2020) question the emphasis on travel reduction, pointing to the negligible contribution of emissions from individual researchers or institutions in the broader context of global climate change. Moreover, they believe that the beneficial outcomes of certain academic endeavours may outweigh the adverse effects of the associated travel.

Despite the growing debate on academic mobility and sustainability, our review of the existing literature shows limited empirical evidence on the attitudinal motivations that influence academics' decisions to travel – or to refrain from traveling – for conference

participation, a central activity in academic life. Focusing on these motivations is particularly relevant given the urgency of achieving sustained reductions in greenhouse gas emissions and the significant contribution of long-distance academic travel to this challenge.

3. Research methodology

This section outlines the overall research approach, including the survey design, the data collection procedure, and the analytical techniques applied.

3.1. Survey design and data collection

In this study, we design a survey to explore academics' expectations regarding conference travel. The target population comprises individuals affiliated with academic institutions in Spain, with a particular focus on those involved in transport-related research. The survey aims at capturing the broad spectrum of career stages, including bachelor's and master's students actively engaged in research activities, predoctoral researchers, postdoctoral researchers, and professors. In this study, the term "professor" refers to academic staff members at the university level and encompasses the various academic ranks recognised within the Spanish higher education system: Teaching Assistant ("Profesor Ayudante"), Assistant Professor ("Profesor Ayudante Doctor"), Associate Professor ("Profesor Contratado Doctor"), Professor ("Profesor Titular"), and Full Professor ("Catedrático de Universidad").

The questionnaire consists of the following five thematic blocks:

- **Block 1. Conference travel habits**. This first block is structured in two sub-blocks:
  - **Block 1.1 Current and preferred attendance**. Participants are requested to indicate the number of conferences they attend per year (distinguishing between events in Europe, outside of Europe, and online), as well as their level of satisfaction with this attendance. Response options include: (a) "I am satisfied with the number of conferences I attend", (b) "I would like to attend more conferences", (c) "I would like to attend fewer conferences". Individuals selecting options (b) or (c) are additionally asked to specify the number of conferences they would ideally prefer to attend annually.
  - **Block 1.2. Minimum attendance**. All participants are also asked to specify their "minimum yearly travel plan", defined as the fewest number of conferences (in Europe, outside Europe, and online) they consider necessary to properly carry out their work within a one-year period. In contrast to the "preferred" number (Block 1.1), which reflects personal aspirations, the "minimum attendance" variable captures the perceived threshold below which academics think their professional performance would be compromised. This measure further enables systematic comparisons between actual behaviour, individual aspirations, and perceived professional requirements, thereby revealing potential gaps between what academics currently do, what they would like to do, and what they feel they must do.
- **Block 2. Willingness to limit conference travel**. In this part, participants are requested to report their intention to limit their conference travel for environmental reasons by responding to the following question, rated on a seven-point Likert-type scale: "Are you willing to limit your conference travel for the sake of the environment? This would mean reducing your personal carbon emissions".
- **Block 3. Personal attitudes and lifestyle preferences**. Based on the literature review conducted in Section 2, seven attitudinal factors are selected to capture academics' motivations towards conference travel: environmental concerns, opportunities for the academic community and science, enjoying travelling, individual performance, significance of face-to-face exchanges, social norms (associated with limiting travel), and ethical responsibilities. Specifically, 49 items from earlier research are adopted and adapted to operationalise these factors. Participants are asked to indicate their level of agreement with each item using a seven-point Likert-type scale, where (1) represents "strongly disagree" and (7) represents "strongly agree".
- **Block 4. Work-related variables**, such as academic position, research field, whether the respondent's daily work involves environmental issues, frequency of teleworking, and the effects of the COVID-19 pandemic on conference travel habits. Teleworking practices are considered, as their widespread adoption has reshaped professional mobility patterns and may affect the regularity and necessity of academic travel. In addition, the COVID-19 variable captures the pandemic's significant impact on academic mobility, disrupting travel patterns and expanding the adoption of virtual alternatives that may continue to influence conference participation.
- **Block 5. Personal characteristics**, such as gender, age, household composition, residential location, and number of years working in academia.

The data collection procedure adhered to strict ethical research standards to ensure transparency and the protection of respondents' rights. Prior to beginning the questionnaire, participants provided informed consent. An introductory page informed them about the objectives of the study, emphasised the voluntary nature of their involvement, clarified their right to withdraw at any time without penalty, and explained the intended use of their data (i.e., for academic purposes).

Specifically, we conducted the survey campaign online, in Spanish, between June and September 2023. We employed two complementary approaches for sample recruitment: (1) distributing flyers in-person (including a QR code and a direct link to the questionnaire) during an international transport conference held in the Canary Islands (Spain), and (2) circulating the questionnaire online through social media platforms (Twitter/X and LinkedIn) and through the mailing lists of academic associations, university departments, and research groups related to transport studies in Spain. To encourage participation, respondents could enter a draw for the chance to win one of five gift cards. Incentives are widely acknowledged as effective in enhancing response rates in survey-based

research (Laguilles et al., 2011; Stahli & Joye, 2016). Before the official launch of the survey, we carried out a pilot test with a sample of 15 participants to assess its validity and identify potential drafting errors. On the basis of the feedback received, we made minor revisions to the structure and wording of some questions.

3.2. Data analysis

To analyse the data collected, we adopt a quantitative approach consisting of three main steps: (i) an Exploratory Factor Analysis (EFA), (ii) a Confirmatory Factor Analysis (CFA), and (iii) a Latent Class Cluster Analysis (LCCA), which has been widely applied in attitude-based segmentation research on mobility. For examples, see Molin et al. (2016), Alonso-Gonzalez et al. (2020), van't Veer et al. (2023), or Soza-Parra & Cats (2024).

This approach makes it possible to examine how a set of factors (capturing attitudes) relate to one another and to classify respondents into distinct clusters. In doing so, it enables the identification of different profiles of academics that vary not only in their attitudes but also in their personal characteristics, thereby providing a clearer understanding of the heterogeneity within the academic population and the specific motivations shaping their travel behaviour, particularly regarding conference attendance. Importantly, this approach also has the potential to inform the design of more targeted and effective policy measures.

Before carrying out these analyses, we clean the data collected and perform a preliminary descriptive evaluation. The following sections describe each step of the analysis in detail.

3.2.1. Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA)

We first perform an EFA aimed at uncovering the latent factor structure underlying the set of attitudinal items measured through the online survey (Section 3.1), while also reducing the number of variables included in the dataset. Specifically, we extract the factors using Principal Axis Factoring (PAF) with varimax orthogonal rotation. To guarantee the adequacy of the dataset for factor analysis, we require a Bartlett's Test of Sphericity p-value below 0.05, a Kaiser-Meyer-Olkin (KMO) value above 0.6, and a correlation matrix determinant exceeding 0.00001 (Field, 2009).

Then, we conduct a CFA to validate the latent factor structure recognised through the EFA, assessing its reliability and validity (Awang, 2014; Shrestha, 2021). Following Fornell and Larcker (1981), we evaluate the Composite Reliability (CR) and the Average Variance Extracted (AVE). A CR value above 0.70 indicates strong internal consistency, while an AVE higher than 0.40 is deemed acceptable when the CR exceeds the minimum threshold (Lam, 2012; Maruf et al., 2021). We also address discriminant validity by comparing the shared variance (i.e., squared correlations) between factors with the average of their AVEs.

Finally, we compute factor scores applying the averaged Sum Score by Factor method. Although some researchers have raised concerns about the precision of this approach compared to alternative factor score estimation techniques (McNeish, 2023), others emphasise its suitability for exploratory studies such as this one (e.g., Lois et al., 2018; Alonso-Gonzalez et al., 2020; Lopez-Carreiro et al., 2021; van 't Veer et al., 2023). This method is particularly effective in preserving the original scale metric, which enhances clarity and interpretability, thereby facilitating direct comparisons across the identified factors (DiStefano et al., 2009).

Overall, the combination of an EFA and a CFA ensures the robustness of the factors adopted in the subsequent analysis.

3.2.2. Latent Class Cluster Analysis (LCCA)

We use the validated factorial structure as input for a LCCA, with the objective of identifying clusters of academics who share similar attitudes towards conference travel, following the approach of Alonso-Gonzalez et al. (2020).

The LCCA "– also referred to as a finite mixture model – groups individuals into different classes according to an unobserved (latent) class variable that explains their responses to a set of observed indicators" (Alonso-González, 2020, p. 25). Its goal is to maximise within-cluster similarity while ensuring distinctiveness across clusters (Sasidharan et al., 2015). As elaborated in Molin et al. (2016),

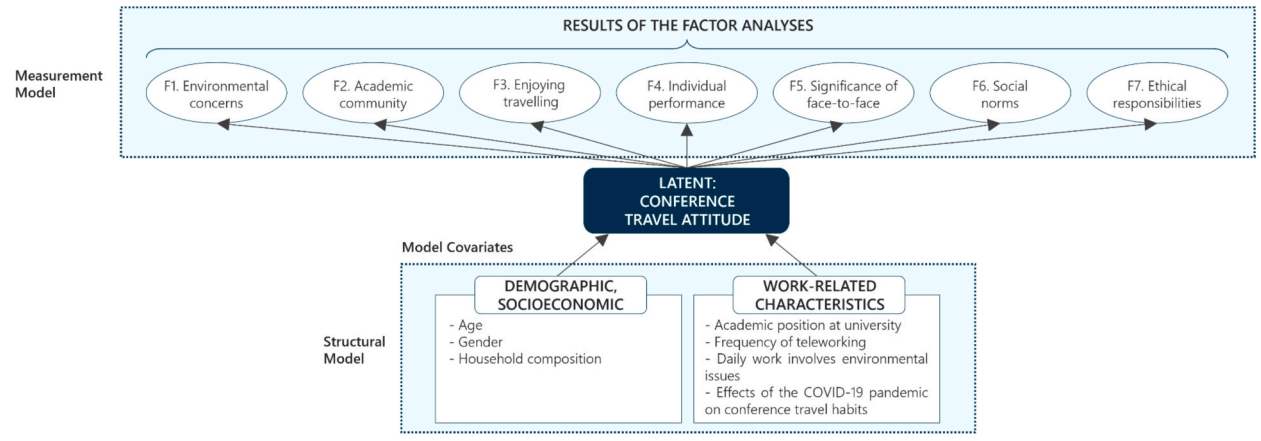

Fig. 1. Latent Class Cluster Analysis (LCCA) of academics' attitudes towards conference travel.

the LCCA allows to (1) assign individuals probabilistically to classes, (2) apply various statistical criteria to determine the optimal number of classes, (3) estimate model parameters and assess their statistical significance, and (4) accommodate variables of mixed-scale type, without the need for standardisation.

Fig. 1 presents the conceptual model guiding the estimation of the LCCA. Conducting an LCCA involves the sequential estimation of two models: a measurement model and a structural model. The measurement model is estimated using only the indicators – in this case, the factors derived from the EFA and the CFA – and enables the determination of the most appropriate number of clusters. This decision

Table 1
Summary of the Spanish sample characteristics.

	Indicator	Category	%	n
Demographic, socioeconomic attributes	Gender	Male	49.4	121
		Female	48.6	119
		Prefer not to answer	2.0	5
	Age (years old)	< 30	24.5	60
		31–40	35.1	86
		41–50	19.6	48
		> 50	20.8	51
	Household structure	*I live…*		
		• Single person	17.6	43
		• With parents	6.9	17
		• With roommates or friends	12.7	31
		• With partner/spouse	26.5	65
		• With partner/spouse and child/children	32.2	79
		• Single parent with child/children	4.1	10
Work-related characteristics	Academic position at university	PhD researcher	24.5	60
		Postdoc researcher	14.3	35
		Professor [a]	46.5	114
		Other (bachelor's/master's students engaged in research activities [b])	14.7	36
	Frequency of teleworking	Never	18.0	44
		Occasionally	24.5	60
		Sometimes	12.7	31
		1–2 days per week	26.5	65
		3–4 days per week	12.7	31
		Always	5.7	14
	Daily work involves addressing environmental issues	Yes	72.7	178
		No	24.9	61
		Prefer not to answer	2.4	6
	"The COVID-19 pandemic has affected my conference travel habits"	1 – Strongly Disagree	11.4	28
		2	9.0	22
		3	8.6	21
		4 – Neutral	13.5	33
		5	16.7	41
		6	10.2	25
		7 – Strongly Agree	30.6	75
Conference travel habits	Conference attendance on an annual basis	Yes – within Europe	82.0	201
		Yes – outside Europe	15.1	37
		Yes – online	47.3	116
	Satisfaction with current conference attendance	"I am satisfied with the number of conferences I attend"	44.5	109
		"I would like to attend more conferences"	53.5	131
		"I would like to attend fewer conferences"	2.0	5
	"I am willing to limit my travel to conferences for the sake of the environment. This would mean reducing my CO_2 emissions"	1 – Strongly Disagree	9.0	22
		2	8.2	20
		3	11.4	28
		4 – Neutral	17.1	42
		5	25.7	63
		6	14.3	35
		7 – Strongly Agree	14.3	35

[a] In this study, the category "professor" refers to academic staff members at the university level. Therefore, it includes the various academic ranks recognised within the Spanish higher education system: Teaching Assistant ("Profesor Ayudante"), Assistant Professor ("Profesor Ayudante Doctor"), Associate Professor ("Profesor Contratado Doctor"), Professor ("Profesor Titular"), and Full Professor ("Catedrático de Universidad").

[b] Refers to bachelor's and master's level students who are actively involved in transport-related research (e.g., working as research assistants) at Spanish institutions.

is informed by model fit indices, including the Bayesian Information Criterion (BIC), the Akaike Information Criterion (AIC), and classification error rates. The structural model is then estimated by incorporating covariates, which help characterise the different clusters identified. In this study, covariates comprise demographic, socioeconomic, and work-related variables. Whenever covariates do not contribute to improving cluster composition, they are treated passively, serving solely to describe their distribution across clusters (Alonso-Gonzalez et al., 2020).

The mathematical formulation of the model incorporating covariates is as follows (Vermunt & Magidson, 2016):

$$f(y_i|z_i^{cov}) = \sum_{x=1}^{K} P(x|z_i^{cov}) \bullet \prod_{m=1}^{M} f(y_{im}|x) \quad (1)$$

Here, x denotes the latent variable with K categories, commonly referred to as latent classes or clusters. Each individual i has a probability of belonging to a specific class, conditional on his/her personal characteristics (i.e., covariates), represented by z_i^{cov}. The first component of the model estimates the likelihood that individual i belongs to a particular class, given his/her covariate profile. The second component captures the probability density of individual's i response to indicator m (y_{im}), given his/her class membership. The total number of observed indicators is denoted by M.

This formulation assumes conditional independence among the indicator variables (Vermunt & Magidson, 2016). Violating this assumption can result in local misfit and reduced model reliability, which can be assessed by examining Bivariate Residual (BVR) values. In applied research, BVRs are often assumed to follow a chi-squared distribution; however, this approximation may not always hold (Oberski et al., 2013). To address this, Oberski et al. (2013) recommend evaluating BVR p-values via parametric bootstrapping. In this study, we adopt this approach in combination with an analysis of the bootstrapped L^2 statistic for overall model fit, as proposed by Oberski (2013).

4. Results

In the following, we start by providing a descriptive analysis of the sample (Section 4.1). Next, we turn to reporting the attitudinal factors identified through the EFA and validated by the CFA (Section 4.2). The modelling results obtained through the LCCA are presented and discussed in Sections 4.3 and 4.4, respectively.

4.1. Sample characterisation

Data collection concluded in September 2023, yielding 245 valid responses from academics affiliated with Spanish institutions. Valid responses refer to fully completed questionnaires without inconsistencies (e.g., missing answers, duplicate submissions, unrealistically short completion times, or implausible/straight-lined responses). Table 1 presents an overview of the main characteristics of the sample.

In reference to individuals' conference travel habits, the results show that more than 80 % of the sample attend these events annually within Europe, whereas only about 15 % travel outside of Europe on a yearly basis. Moreover, responses regarding academics' willingness to limit their travel to conferences for environmental reasons provide additional insights: only 28.6 % of the respondents expressed some level of disagreement with this statement.

The questionnaire also assesses academics' current and preferred levels of conference attendance (Block 1.1). Specifically, respondents indicate the number of conferences they attend on an annual basis, as well as their level of satisfaction with this frequency: (a) 44.5 % of the sample are "satisfied with the number of conferences they attend on an annual basis"; (b) 53.5 % "would like to attend more conferences"; and (c) 2.0 % "would like to attend fewer conferences". Those respondents who are non-satisfied – groups (b) and (c) – are additionally asked to specify the number of conferences they would have liked to attend. Separately, all respondents define

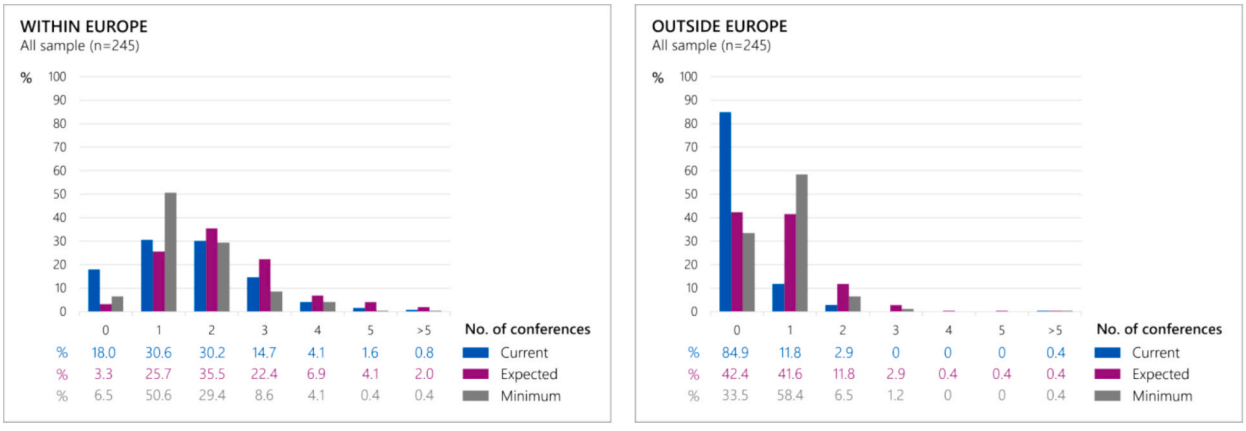

Fig. 2. Academics' perspectives of conference travel within and outside Europe: comparison between the minimum number of conferences that academics consider necessary, their current behaviour, and their expectations.

their "minimum yearly travel plan" (Block 1.2). This involved indicating the minimum number of conferences that, in their view, they must attend each year to perform their work properly, both within Europe and outside Europe. The comparison between the minimum number of conferences that academics consider necessary, their current behaviour, and their expectations towards these events provides insights into potential gaps between actual practice and perceived professional requirements (Fig. 2).

Regarding European conferences, we observe that 93.5 % of the sample considers that attending at least one event per year is necessary to carry out their job effectively. However, 18 % of respondents are not currently meeting this self-defined requirement. We therefore note that for some individuals, their current behaviour does not align with the "minimum" level of attendance they consider essential. In relation to conferences outside of Europe, 66.5 % of the sample states that attending at least one conference a year is key to the successful development of their work. Nevertheless, almost 85 % of our respondents do not meet this figure. Here, it is also important to note that the number of conferences outside of Europe that respondents expect to attend significantly exceeds the number they actually travel to.

Next, we turn to comparing those academics who are "satisfied with the number of conferences they attend on an annual basis" and those who "would like to attend more conferences" in terms of their current travel frequency and their views on expected and minimum travel levels, see Fig. 3. Individuals who "would like to attend fewer conferences" are not considered due to their low representativeness in the sample.

Overall, we observe that the two profiles show a similar perception in relation to the minimum number of conferences required for doing their job well. While they also show an analogous behaviour outside Europe, we identify differences in relation to the number of European conferences that they currently attend: those who "would like to attend more conferences" travel less than those who are "satisfied". Additionally, it is essential to note that approximately 70 % of the "non-satisfied academics" (i.e., those who would like to travel more) would prefer to attend two or more European conferences per year and at present only 30 % meet this expectation. A similar trend can be observed in relation to conferences outside Europe. Although nearly 90 % would like to attend at least one conference per year, only about 10 % do so on an annual basis.

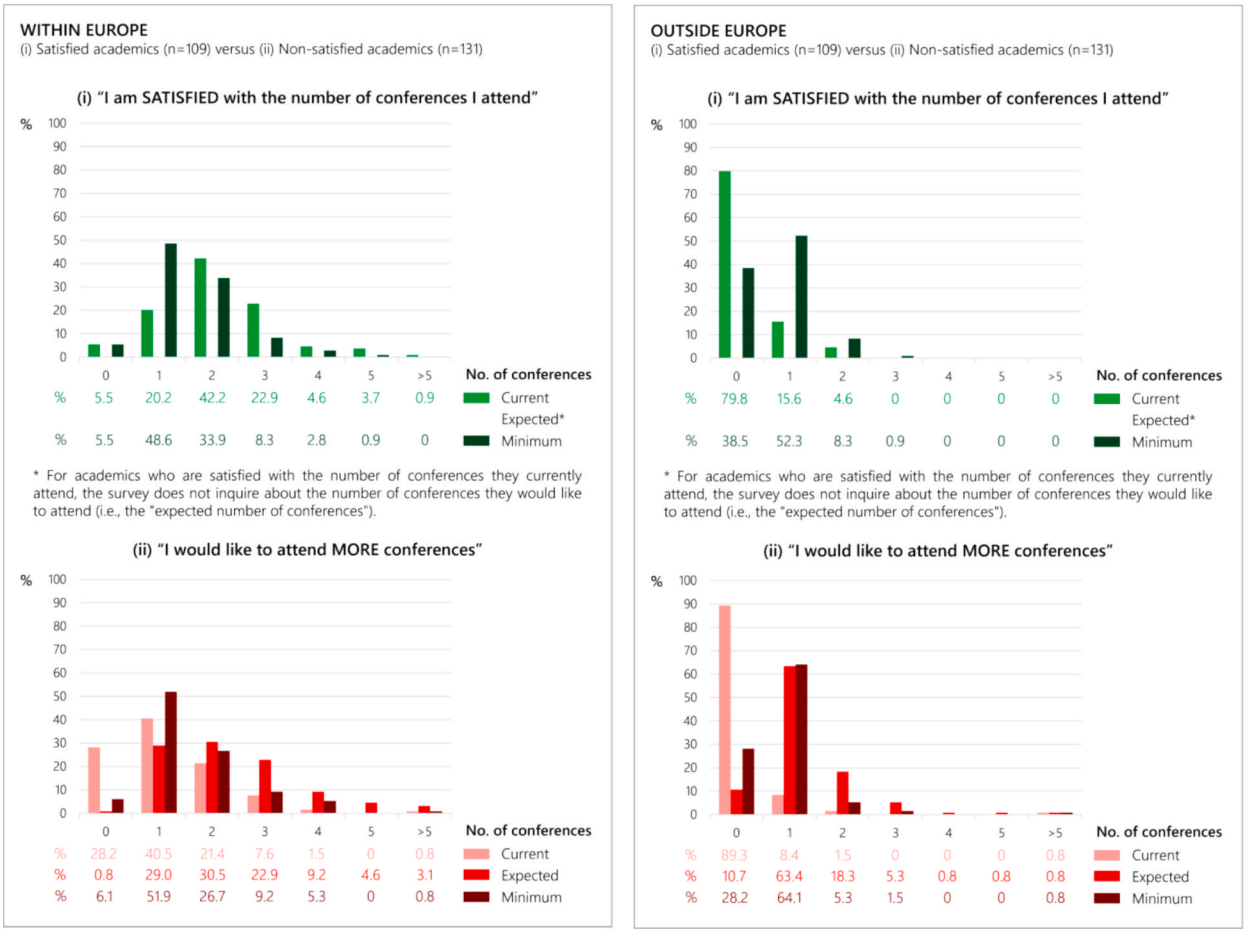

Fig. 3. Comparison between academics "satisfied with the number of conferences they attend on an annual basis" and academics who "would like to attend more conferences" (i.e., non-satisfied academics), in terms of their current travel frequency and their views on expected and minimum travel levels.

Table 2
Results of the Exploratory Factor Analysis (EFA): academics' attitudes towards conference travel.

Factor name		Item	Factor loadings						
F1. Environmental concerns	EC1	I am very concerned about global warming	0.903						
	EC2	Climate change is a serious problem	0.860						
	EC3	We must act and take decisions to limit our environmental impact	0.850						
	EC4	I am concerned about the environmental impact of my trips	0.777						
	EC5	We must take CO2 emissions into account when planning business trips	0.773						
	EC6	I am willing to pay more for those products that are more environmentally friendly	0.757						
	EC7	In general, we should travel less to protect the environment	0.676						
F2. Opportunities for the academic community and science	*Attending conferences…*								
	OA1	…benefits the scientific community by increasing the opportunities for learning, networking, etc.		0.796					
	OA2	… is key to establish critical dialogues with other researchers		0.792					
	OA3	… is necessary for the exchange of knowledge between researchers		0.791					
	OA4	… is essential to get updated on the latest breakthroughs, emerging fields, etc.		0.741					
	OA5	… favours a "sense of scientific community" that prevents researchers from feeling isolated		0.707					
F3. Enjoying travelling	ET1	Travelling is part of my lifestyle			0.867				
	ET2	I enjoy travelling			0.848				
	ET3	Looking for adventures is important to me			0.828				
	ET4	The academic career is more attractive because of the opportunities it offers to travel			0.684				
F4. Individual performance	*Attending conferences…*								
	IP1	… is key to increase my professional reputation				0.764			
	IP2	… is necessary to build/expand my professional network				0.706			
	IP3	… is necessary for my professional development/ progression within the university sector				0.681			
	IP4	… is essential to do my job properly				0.613			
F5. Significance of face-to-face exchanges	SF1	Face-to-face conferences help me capture the attention of the audience better than online conferences					0.737		
	SF2	Online conferences make it difficult to read body language					0.652		
	SF3	I prefer face-to-face conferences over online conferences					0.641		
	SF4	Face-to-face conferences are necessary to communicate complex ideas accurately					0.611		
F6. Social norms	SN1	Some of the people I know are willing to limit their travel to protect the environment						0.747	
	SN2	Some of the people I know have asked me to do more to protect the environment						0.734	
	SN3	The more other researchers reduce their travel to conferences, the more I will						0.617	
F7. Ethical responsibilities	ER1	I feel obliged to spend public funds responsibly when I attend a conference							0.784
	ER2	I feel responsible for working to improve the welfare of society							0.765

A KMO of 0.836 is obtained, showing good sample adequacy (Hutcheson & Sofroniou, 1999), the Bartlett's test of sphericity results are significant (<0.001), indicating sufficient relations between indicators, and the correlation matrix determinant is greater than 0.00001.

4.2. Factor analyses

After describing the sample and their conference travel habits, we proceed to perform the factor analyses. First, we conduct an EFA using the PAF extraction method with varimax orthogonal rotation to investigate the latent factor structure underlying the set of attitudinal items measured in the survey. We carry out the analysis with IBM SPSS Statistics (Version 29.0). In total, seven attitudinal factors are revealed, explaining 67 % of the variance: (F1) environmental concerns, (F2) opportunities for the academic community and science, (F3) enjoying travelling, (F4) individual performance, (F5) significance of face-to-face exchanges, (F6) social norms (associated with limiting travel), and (F7) ethical responsibilities. While this set of factors coincide with those selected from the literature review and considered in the conceptual model, some of their items are eliminated. Following the "two-indicator rule" (Bollen, 1989), each factor is required to retain at least two items, with a minimum factor loading of 0.60. Table 2 summarises the factors obtained, their corresponding items, and the factor loadings for the rotated pattern matrix.

Subsequently, we conduct a CFA using the *lavaan* package in RStudio (Prokofieva et al., 2023). All identified factors meet the reliability criteria established in Section 3.2.1 (see Tables 2 and 3), confirming their suitability for further analysis. We then calculate the factor loadings based on the averaged Sum Score by Factor method, in accordance with the approach taken in previous research (e.g., Lois et al., 2018; Alonso-Gonzalez et al., 2020; Lopez-Carreiro et al., 2021; van 't Veer et al., 2023).

To further investigate the seven identified attitudinal factors, we examine the distribution of responses and the mean values (M) of their corresponding items, as presented in Fig. 4. The first seven statements capture individuals' environment-related attitudes (F1), showing that the main barrier appears to be their intention to limit their travel for environmental reasons (EC4: M = 4.99; EC5: M = 5.25; EC7: M = 4.60), despite high levels of climate awareness (EC1 and EC2 both have mean values above 6.00). Statements 8 to 12 (F2) note that, in general, individuals believe that conference travel is fundamental to the academic community and to the advancement of science (mean values ranging from 5.48 to 6.10), which might represent an obstacle in restraining this practice.

Regarding enjoyment of travelling (F3, statements 13 to 16), respondents express generally positive attitudes (e.g., ET2: M = 6.14), suggesting that they take pleasure in mobility-related experiences. However, when asked whether an academic career is more attractive because of the opportunities it offers to travel (ET4: M = 4.75), the mean value decreases considerably. In terms of individual performance (F4, statements 17 to 20), we observe that academics tend to believe that conference participation is key to enhancing their reputation and building professional networks (IP1: M = 5.64; IP2: M = 6.15), although they appear less convinced that conference travel is essential for doing their job properly (IP4: M = 5.22).

Statements 21 to 24 (F5) suggest that academics tend to prefer face-to-face exchanges (e.g., SF1: M = 6.07; SF3: M = 6.14), even if they do not consider them strictly necessary to fulfil their professional duties. Then, statements 25 to 27 (F6) show comparatively low mean values (SN1: M = 3.78; SN2: M = 2.52; SN3: M = 3.58), indicating limited adherence to social norms that promote mobility reduction. Finally, statements 28 and 29 on ethical responsibilities (F7), appear to reveal a strong awareness of the use of public funds (ER1: M = 6.29) and a clear commitment to improving societal welfare (ER2: M = 5.98).

4.3. Latent class model

Following the factor analyses, we perform a LCCA on the indicators (factor scores) and covariates (observed variables) presented in Fig. 1, using the *poLCA* package in RStudio (Linzer & Lewis, 2011). First, we estimate the measurement model based on the seven factors identified in Section 4.2 to establish the optimal number of latent classes. Since these factors are continuous variables – calculated via the averaged Sum Score by Factor method – chi-squared statistics are not applicable (van 't Veer et al., 2023). Consequently, in line with the approach of Alonso-Gonzalez et al. (2020), we rely on BIC and AIC goodness-of-fit values, together with the examination of cluster profiles, to determine the number of classes. We also assess classification errors.

We evaluate model fit statistics for solutions ranging from two to five classes (Fig. 5). Guided by the Log-Likelihood, BIC, and AIC criteria, both the two-cluster and three-cluster models appear to be appropriate. However, after examining the cluster profiles and the distribution of individuals across groups, we select the three-class model as the most adequate. This solution exhibits an entropy value of 0.775, thereby indicating a fair prediction of cluster membership (Alonso-Gonzalez et al., 2020).

The next step consists of integrating the measurement and structural models to examine the effects of covariates on latent class membership. Although the inclusion of covariates may lead to changes in cluster composition, it improves the differentiation of individuals across groups. Following Alonso-Gonzalez et al. (2020), we conduct the covariate analysis by type, according to the two categories outlined in Fig. 1: demographic and socioeconomic attributes, and work-related characteristics. We then add all statistically

Table 3
Cronbach's alpha (α), Composite Reliability (CR), and Average Variance Extracted (AVE).

Factor name	Cronbach's alpha (α)	Composite Reliability (CR)	Average Variance Extracted (AVE)
F1. Environmental concerns	0.912	0.93	0.67
F2. Opportunities for the academic community and science	0.860	0.88	0.59
F3. Enjoying travelling	0.836	0.88	0.66
F4. Individual performance	0.804	0.79	0.48
F5. Significance of face-to-face exchanges	0.674	0.76	0.44
F6. Social norms	0.638	0.74	0.49
F7. Ethical responsibilities	0.548	0.75	0.60

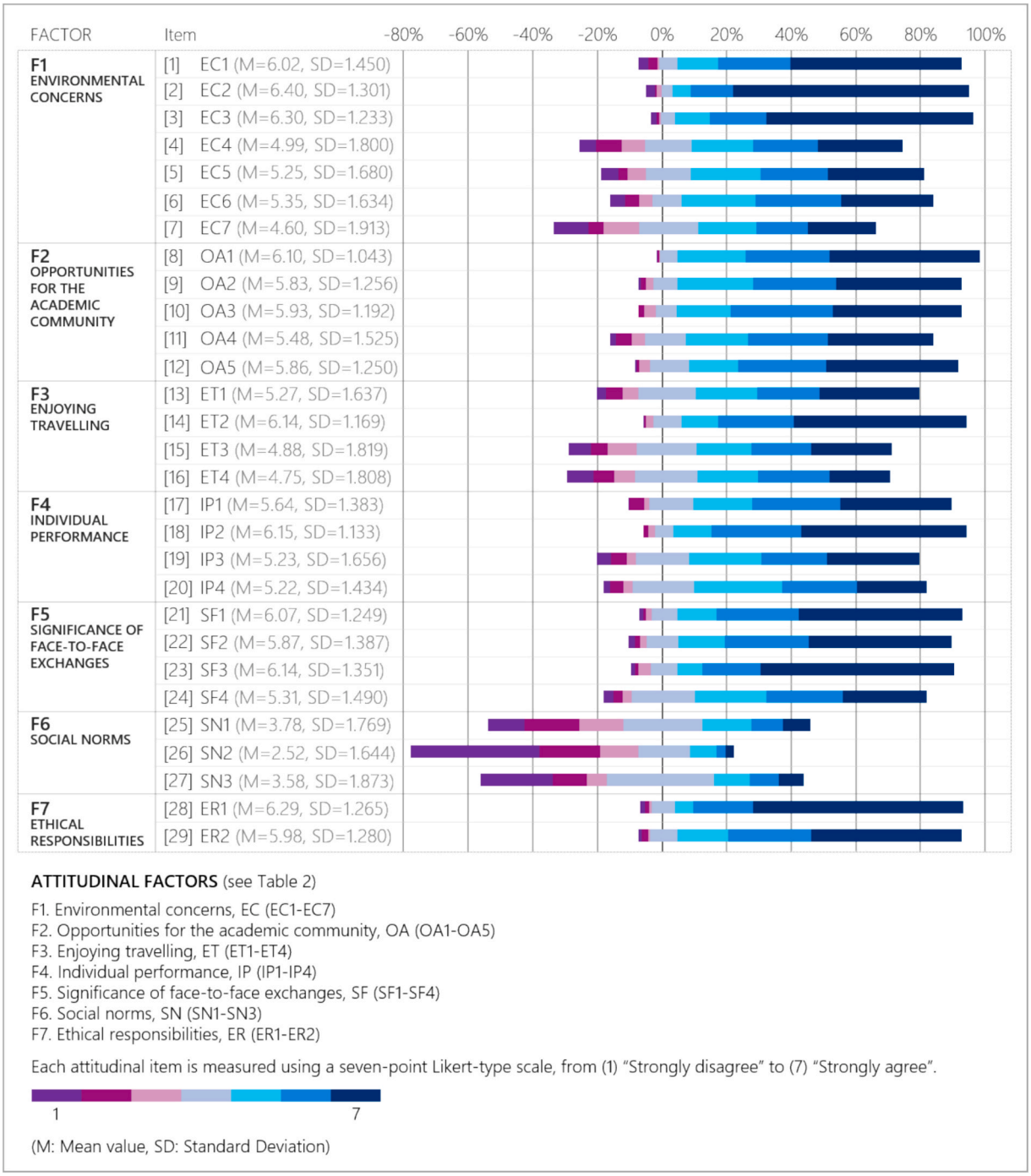

Fig. 4. Results of the 29 attitudinal items measured through the online survey (Block 3), corresponding to the seven identified attitudinal factors.

significant covariates ($p < 0.05$) to the model incrementally – one at a time – and remove them if they lose significance when combined with others. In this study, no covariates are retained in the final model.

The average values of the seven factors for each of the three clusters obtained are graphically displayed in Fig. 6. Based on the factor values, we name the clusters as follows:

- Cluster 1 (30.2 %): "Low-concerned academics". This cluster shows the lowest average values on five of the seven indicators in comparison with the other two clusters. These individuals are characterised by particularly low scores on (F1) environmental

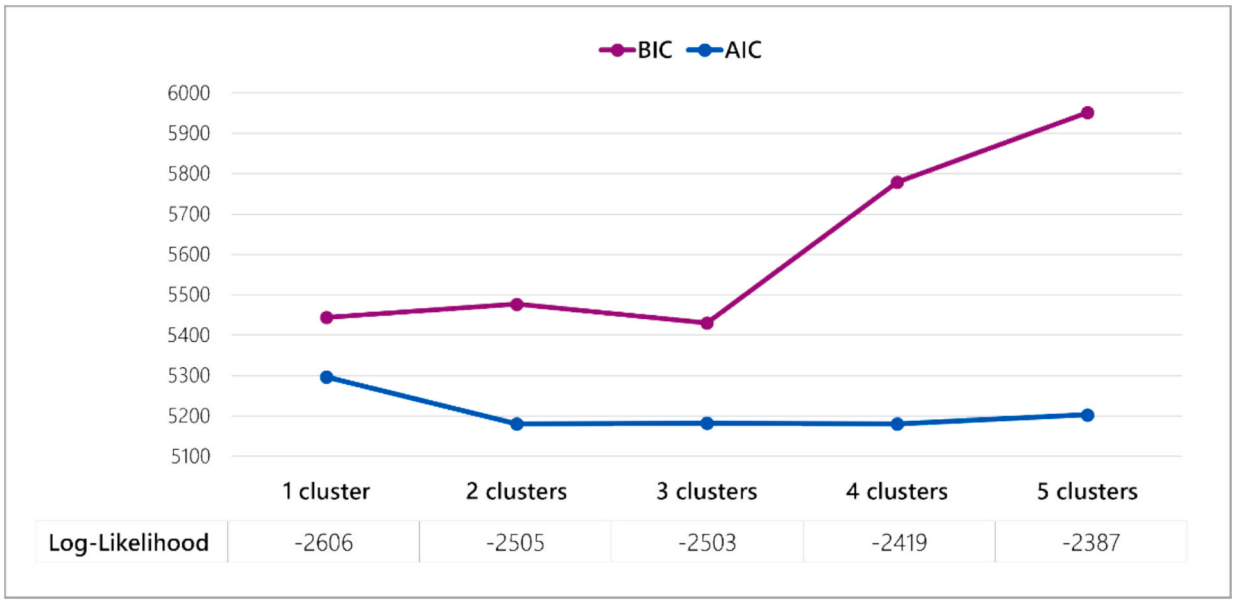

Fig. 5. Latent Class Model fit statistics.

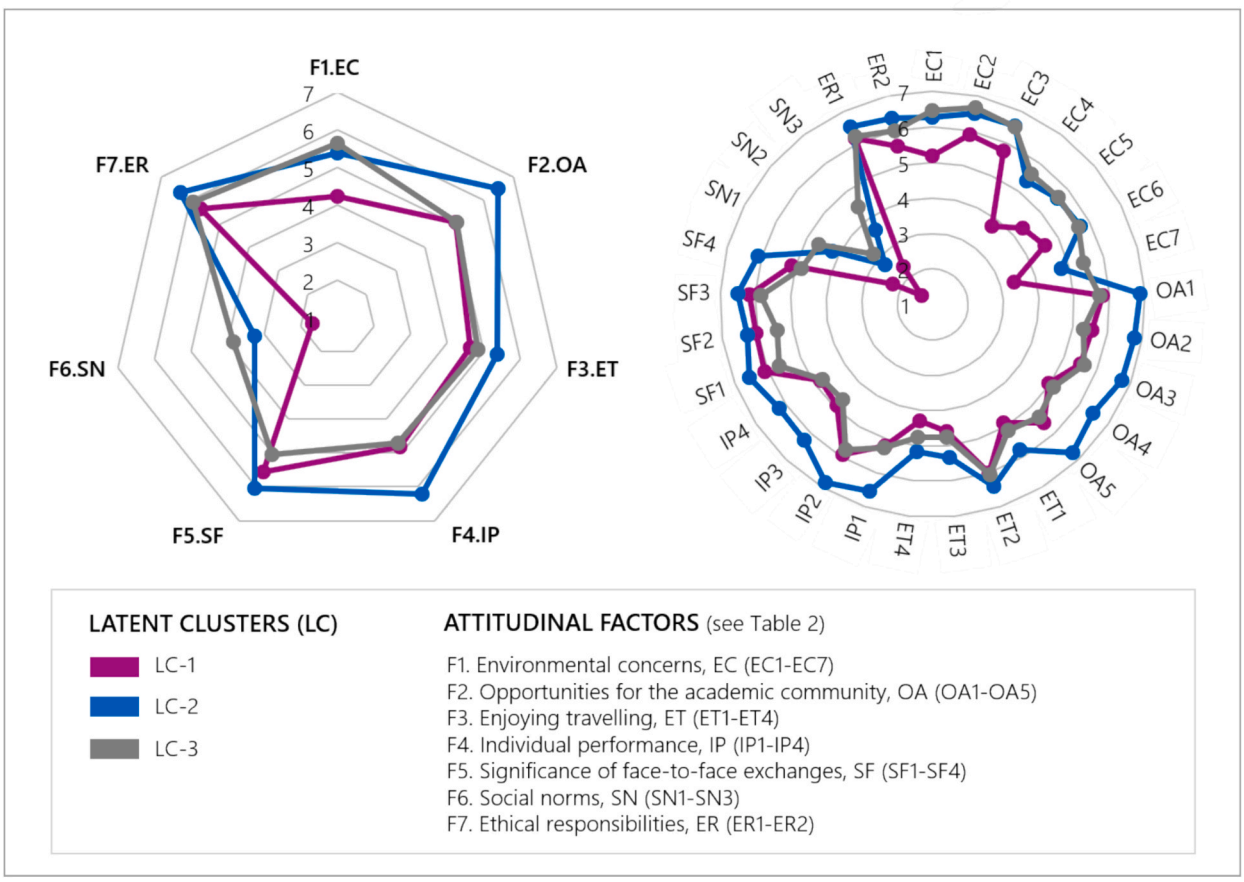

Fig. 6. Average scores of the seven factors across the identified clusters, along with the average scores of the attitudinal indicators associated with each factor.

concerns, referring to ecological awareness, and (F6) social norms, which reflect the assumed expectations of significant others that one should adopt certain behaviours.

- Cluster 2 (30.5 %): "Performance-oriented academics". This cluster reports the highest average values on five of the seven indicators compared to the other two clusters. They can be considered performance-oriented given their emphasis on creating opportunities for the academic community and science (F2), their focus on individual performance and academic achievement (F4), their preference for face-to-face events (F5), and their sense of ethical responsibility within academia (F7). In addition, they report the highest level of enjoyment associated with travelling, on average (F3).
- Cluster 3 (39.3 %): "Flight-shamed academics". The largest of the three clusters can be viewed as the opposite of Cluster 1, showing the highest average values on two of the seven indicators relative to the other two clusters: (F1) environmental concerns and (F6) social norms. These individuals are concerned about the environmental impact of their actions and are likely to feel a strong sense of obligation – or perceived social pressure – to adopt certain behaviours.

4.4. Cluster characterisation

We further profiled the three clusters obtained based on their composition in terms of: (i) demographic and socioeconomic attributes, (ii) work-related characteristics, and (iii) perspectives on conference travel habits. These variables are discussed in the subsequent Sections.

4.4.1. Demographic and socioeconomic attributes of the clusters

The composition of each of the clusters in terms of age, gender, and household structure is presented in Table 4.

Compared to the sample average, "Low-concerned academics" are over-represented among males, while under-represented in the case of females. Additionally, this group has a higher proportion of individuals aged 40 years or younger, with a notable concentration in the 31–40 age group (42.5 %). Conversely, the percentage of individuals over 40 years old is lower. In terms of household structure, the cluster is over-represented in the category of "living with parents" and under-represented in "living with partner/spouse and child/children". Nevertheless, this latter category still represents the most common living arrangement within the group, accounting for almost 30 % of its members.

In the case of "Performance-oriented academics", the proportion of males is lower in comparison with the sample average, while that of females is higher. Regarding age, this cluster is under-represented among those academics under the age of 30 and over-represented in the other age groups. Lastly, when addressing the household organisation, we detect that these academics are over-represented in the categories of "living alone", "living with partner/spouse", and "living with partner/spouse and child/children", whereas under-represented in "living with parents" and "living with roommates or friends".

Finally, "Flight-shamed academics" exhibit a gender distribution similar to that of "Low-concerned academics", but with a lower share of females. This group is under-represented among individuals aged 31–40, while it is over-represented among those under 30. In terms of household structure, these individuals are over-represented in the category of "living with roommates or friends" and slightly under-represented in the categories of "living alone", "living with partner/spouse", and "living with partner/spouse and child/children" – highlighting a contrast with the household composition of the "Performance-oriented academics".

In summary, we detect distinct demographic and socioeconomic patterns between the different profiles of academics. These

Table 4
Demographic and socioeconomic attributes of the three clusters. For each variable, the group with the highest share is highlighted in bold.

Latent Cluster (LC)		**LC-1** Low-concerned academics	**LC-2** Performance-oriented academics	**LC-3** Flight-shamed academics	**Overall sample averages**
Demographic, socioeconomic attributes (%)		30.2 %	30.5 %	39.3 %	–
Gender	Male	**58.9**	33.3	**54.0**	49.4
	Female	35.6	**66.7**	45.0	48.6
	Prefer not to answer	5.5	0.0	1.0	2.0
Age (years old)	< 30	27.4	13.9	**30.0**	24.5
	31–40	**42.5**	**37.5**	28.0	35.1
	41–50	15.1	23.6	20.0	19.6
	> 50	15.1	25.0	22.0	20.8
Household structure	*I live...*				
	• Single person	17.8	19.4	16.0	17.6
	• With parents	11.0	2.8	7.0	6.9
	• With roommates or friends	11.0	8.3	17.0	12.7
	• With partner/spouse	27.4	26.4	26.0	26.5
	• With partner/spouse and child/children	**28.8**	**40.3**	**29.0**	32.2
	• Single parent with child/children	4.1	2.8	5.0	4.1

variations suggest that attitudes towards conference travel may be influenced by the personal characteristics under study (i.e., gender, age, and household structure).

4.4.2. Work-related characteristics of the clusters

A comprehensive analysis of the work-related characteristics of the three clusters obtained is summarised in Table 5, including academic position at university, frequency of teleworking, daily involvement in solving environmental issues, and the impact of the COVID-19 pandemic on conference travel habits.

In terms of academic position, all clusters exhibit a similar share of professors, with each group comprising nearly 50 % in this category. Additionally, the cluster of "Low-concerned academics" includes a substantial proportion of predoctoral and postdoctoral researchers, accounting for approximately 46 %, whereas the "Performance-oriented academics" show a lower representation of these early-career individuals, at around 30 %. Meanwhile, the "Flight-shamed academics" display the highest proportion of predoctoral researchers, but the lowest representation of postdoctoral members.

When assessing the frequency of teleworking, we observe that both the "Low-concerned academics" and the "Flight-shamed academics" present a similar pattern, with relatively high shares working remotely one to two days per week. In contrast, the "Performance-oriented academics" cluster demonstrates a distinct trend, with the highest share reporting frequent telework of three to four days per week. Furthermore, nearly 30 % of individuals in this cluster report teleworking only occasionally.

As for the presence of "green" issues in daily work, both "Low-concerned academics" and "Performance-oriented academics" show analogous figures, with around 70 % of their members dealing with these aspects. This percentage increases to nearly 80 % among "Flight-shamed academics", underscoring their more frequent professional involvement in sustainability-related activities.

The survey also explores individuals' perception of the effects of the COVID-19 pandemic on conference attendance, using the following statement rated on a seven-point Likert-type scale: "The COVID-19 pandemic has affected my conference travel habits". Around 20 % of "Low-concerned academics" strongly disagree with it. The corresponding figures for the "Performed-oriented academics" and the "Flight-shamed academics" are notably lower, at 11 % and 4 %, respectively. At the same time, almost 40 % of the "Performed-oriented" and 35 % of the "Flight-shamed" academics strongly agree with this proposition – compared to only 18 % in the "Low-concerned" group. This suggests a greater adaptation or re-evaluation of travel needs among the former two groups.

Similar to Section 4.4.1, we observe varying work-related characteristics across the different clusters.

Table 5
Work-related characteristics of the three clusters. For each variable, the group with the highest share is highlighted in bold.

Latent Cluster (LC)		**LC-1** Low-concerned academics	**LC-2** Performance-oriented academics	**LC-3** Flight-shamed academics
Work-related characteristics (%)		30.2 %	30.5 %	39.3 %
Academic position at university	PhD researcher	26.1	13.8	31.6
	Postdoc researcher	20.3	15.8	8.4
	Professor [a]	**45.2**	**48.5**	**46.1**
	Other (bachelor's/master's students engaged in research activities [b])	8.4	21.9	13.9
Frequency of teleworking	Never	20.5	18.3	15.8
	Occasionally	20.7	**27.9**	24.8
	Sometimes	16.1	11.9	10.6
	1–2 days per week	**27.3**	18.8	**31.9**
	3–4 days per week	9.5	19.5	9.7
	Always	5.9	3.6	7.2
Daily work involves addressing environmental issues	Yes	**68.5**	**70.0**	**77.9**
	No	31.0	28.6	17.4
	Prefer not to answer	0.5	1.4	4.7
"The COVID-19 pandemic has affected my conference travel habits"	1 – Strongly Disagree	**20.8**	11.4	4.2
	2	10.4	6.6	9.7
	3	11.4	5.4	8.9
	4 – Neutral	11.4	15.9	13.1
	5	14.0	12.1	22.4
	6	13.7	10.2	7.6
	7 – Strongly Agree	18.3	**38.4**	**34.1**

[a] In this study, the category "professor" refers to academic staff members at the university level. Therefore, it includes the various academic ranks recognised within the Spanish higher education system: Teaching Assistant ("Profesor Ayudante"), Assistant Professor ("Profesor Ayudante Doctor"), Associate Professor ("Profesor Contratado Doctor"), Professor ("Profesor Titular"), and Full Professor ("Catedrático de Universidad").

[b] Refers to bachelor's and master's level students who are actively involved in transport-related research (e.g., working as research assistants) at Spanish institutions.

4.4.3. Conference travel habits of the clusters

We observe consistent patterns in perceptions of conference travel habits across the three clusters. Approximately 40–45 % of respondents are satisfied with their current behaviour, some 50–55 % would like to travel more, and only around 1–3 % would prefer to reduce their conference attendance. Among this latter small group, 60 % belong to the "Flight-shamed academics" cluster.

To further explore these findings, we examine potential similarities and differences among the clusters regarding the minimum number of conferences they consider necessary to do their job properly, their current behaviour, and their expectations for future participation in such events, both within and outside Europe. The results are presented in Figs. 7 and 8, respectively.

The current habits of the "Low-concerned academics" largely align with their expectations for the European context (Fig. 7). However, it is noteworthy that although nearly 99 % of this group expects to attend at least one conference per year, about 14 % of them do not. The relationship between the habits and expectations of the "Performance-oriented academics" is similar to that of the "Flight-shamed academics". For all three clusters, more than 90 % of respondents believe that attending at least one conference per year is necessary to perform their work effectively – yet this minimum is not met in any of the cases.

In general, we observe that travel to conferences outside Europe is infrequent within our sample. More than 80 % of each group reports not travelling beyond Europe on an annual basis. In this context, expectations regarding conference travel are similar among the three groups, as well as their views on the minimum number of conferences necessary per year for professional success (Fig. 8). Note that around 60–70 % of each group consider attending at least one conference outside Europe per year as the minimum requirement.

5. Discussion and policy recommendations

In this section, we discuss the main findings of the study in light of the existing literature, highlighting the heterogeneity observed within the academic community. Building on these insights, we also outline some relevant policy recommendations aimed at supporting more sustainable behaviours.

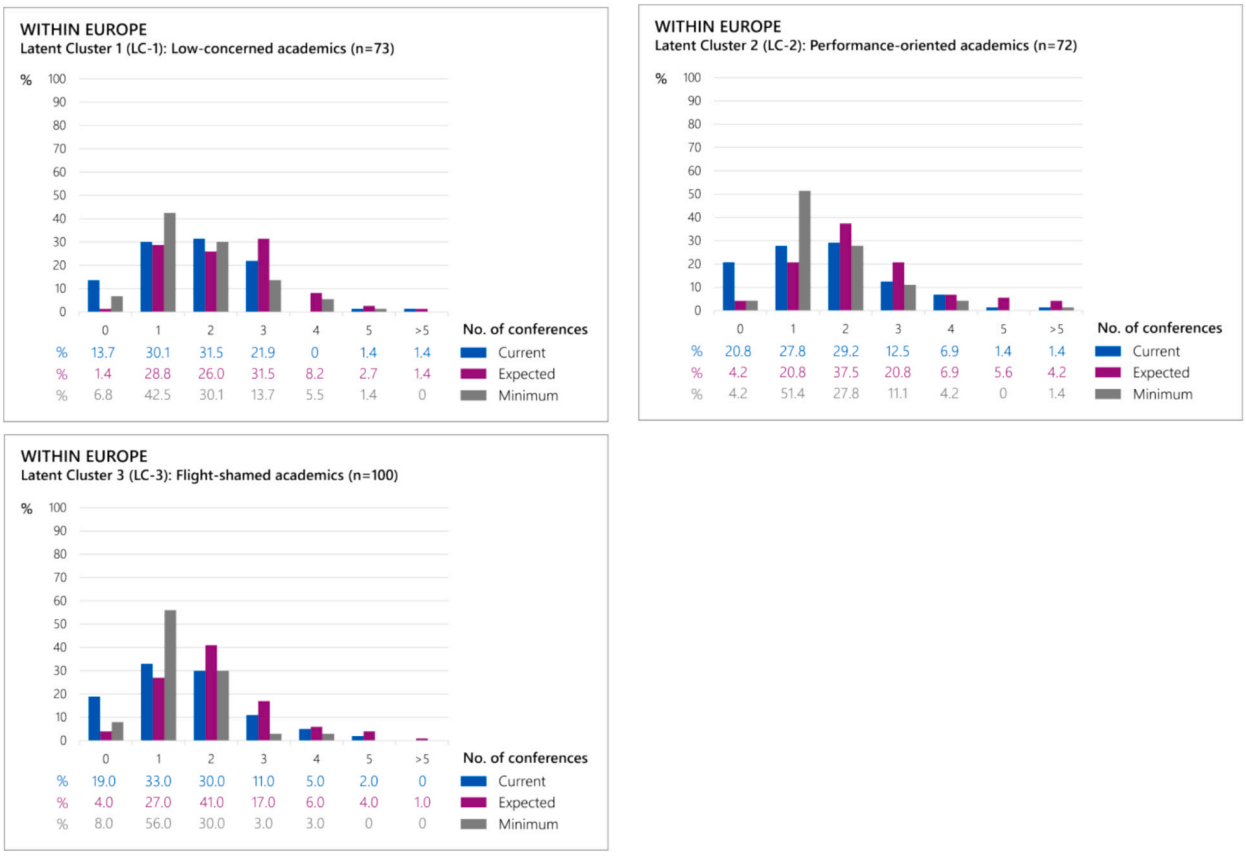

Fig. 7. Clusters' perspectives of conference travel within Europe: comparison between the minimum number of conferences that academics consider necessary, their current behaviour, and their expectations.

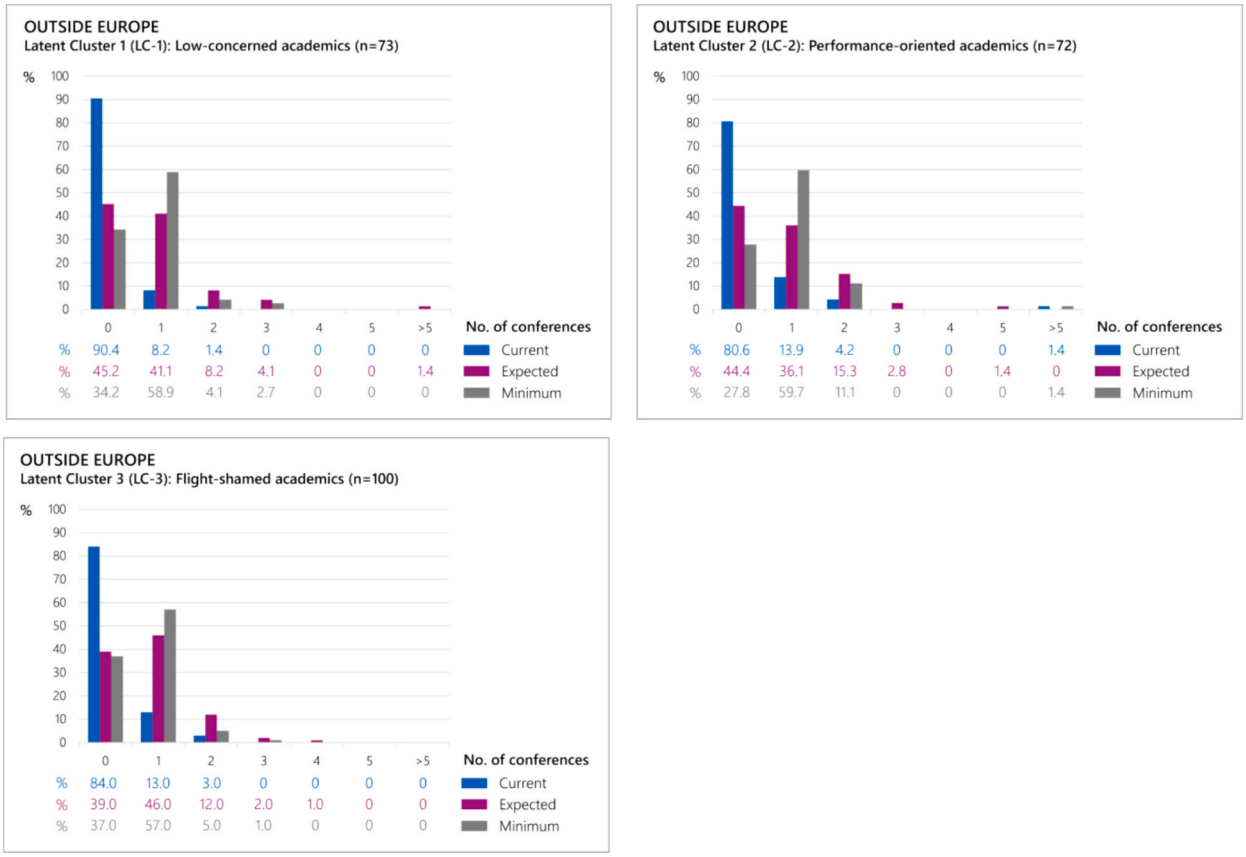

Fig. 8. Clusters' perspectives of conference travel outside Europe: comparison between the minimum number of conferences that academics consider necessary, their current behaviour, and their expectations.

5.1. Heterogeneity in conference travel among academics

Seven attitudinal factors are revealed to explain academics' motivations towards conference travel: environmental concerns, opportunities for the academic community and science, enjoying travelling, individual performance, the significance of face-to-face exchanges, social norms (associated with limiting travel), and ethical responsibilities.

Notably, the results for the social norms factor indicate that respondents in our sample do not appear to be significantly influenced by their peers when deciding whether to travel or not. As illustrated in Fig. 6, this factor exhibits the lowest mean scores among the seven attitudinal factors identified (M − LC1 = 1.68; Mean − LC2 = 3.26; M − LC3 = 3.85). This suggests that personal beliefs and expectations outweigh social pressure in shaping travel behaviour among academics. This finding stands in contrast to previous research, which points to a stronger influence of the academic community on individuals' practices (Wenger, 2025). Conversely, factors such as opportunities for the academic community and science, ethical responsibilities, and the significance of face-to-face exchanges appear to play a more prominent role. As illustrated in Fig. 6, these factors exhibit comparatively higher mean scores than the other attitudinal dimensions. The first two factors emphasise that academics are primarily motivated by a commitment to advancing science, supporting colleagues, and fulfilling ethical obligations, ensuring that their professional conduct aligns with broader societal values. The third factor underscores the relevance of in-person contact within academic settings. This preference may partly reflect the persistent effects of the COVID-19 pandemic, which severely restricted opportunities for direct interpersonal communication. As noted in Section 2, previous studies also suggest that face-to-face interactions generally continue to represent the predominant form of academic engagement (Werker & Ooms, 2020; Kreil, 2021; Ahonen & Rask, 2024).

According to their attitudinal features, the clusters identified are labelled as follows: "Low-concerned academics", "Performance-oriented academics", and "Flight-shamed academics". Each of the groups is defined by a distinctive set of demographic and socio-economic attributes, work-related characteristics, and conference travel habits.

Specifically, the "Low-concerned academics" cluster comprises younger individuals (below 40 years of age) and a higher proportion of men compared to the sample average. Consistent with earlier studies (Lassen, 2010; Abdiraiymova et al., 2019), these relatively young academics appear to place considerable value on face-to-face exchanges, viewing them as essential for their career development and progression. Moreover, research on environmental attitudes in the past few decades consistently shows that women tend to express slightly greater green concerns than men (McCright & Xiao, 2014). This gender difference may help explain the lower prioritisation of

environmental considerations observed within this male-dominated cluster.

Similarly, the "Flight-shamed academics" cluster includes a high proportion of individuals under 40. Its members are particularly characterised by their professional focus on green issues in their daily work and by a notably higher frequency of teleworking in comparison with the other two groups. This involvement with digital practices – which can help reduce the need for physical mobility – is usually associated with greater environmental consciousness (Wenger, 2023). Previous research has likewise linked teleworking with younger individuals (de Graaff & Rietveld, 2004; de Abreu e Silva & Melo, 2018).

In contrast to the previous two profiles, the "Performance-oriented academics" cluster is under-represented by predoctoral and postdoctoral researchers, likely reflecting the increasing demands and responsibilities associated with the later stages of an academic career. Consequently, this cluster has a significant share of individuals over the age of 40. Consistent with the findings of De Vos et al. (2024), senior members of this group tend to prioritise traditional face-to-face exchanges and engage less frequently in online activities, which aligns with their relatively low levels of teleworking. As noted by Wenger (2023, p. 6), "senior researchers generally wish to maintain face-to-face interactions as a norm". This cluster also shows a notable over-representation of women. It is worth noting that the women included in this group appear to contrast with the broader evidence discussed earlier, which suggests that women generally express stronger environmental concerns than men. Our results may therefore point to a discrepancy between women overall and those within the transport research community. These findings highlight the need for further investigation into how gendered patterns of environmental concern interact with academic career trajectories.

With respect to work-related characteristics across the three clusters, it is relevant to highlight the differing perceptions of how the COVID-19 pandemic has affected conference travel habits. While some individuals strongly disagree that the pandemic has influenced their practices, others strongly agree, revealing a broad spectrum of behavioural responses and adaptations within the sample. This diversity of perceptions underlines the nuanced ways in which individuals have adjusted to the challenges posed by the pandemic, reflecting the complex interplay between personal circumstances, professional obligations, and broader societal shifts (Akkermans et al., 2020; Hite & McDonald, 2020).

Finally, regarding conference travel habits, respondents in our sample indicate that they travel more frequently to conferences within Europe than to those held outside the continent. In general, scholars agree on the importance of regularly attending conferences which take place outside Europe in order to effectively perform their work. As noted in Section 4, it is noteworthy that – irrespective of their cluster – only 1–3 % of the individuals surveyed would like to reduce their conference attendance.

5.2. *Policy recommendations*

Based on the heterogeneity revealed in the previous section, we formulate a set of targeted policy recommendations that might foster more sustainable conference travel behaviours across the academic community, with a specific focus on the three identified clusters: "Low-concerned academics", "Performance-oriented academics", and "Flight-shamed academics".

Even though nearly 70 % of the "Low-concerned academics" report addressing "green" issues in their daily work (Table 5), a substantial proportion express limited concern regarding the environmental impact of their conference travel and show little consideration for social norms related to sustainability. While there seems to be a wide-spread belief in the importance of raising awareness and sharing information about the environmental effects of one's choices, evidence from the recent review by Albarracín et al. (2024) suggests that the key determinants of environmental behaviour change are established habits and the availability of viable alternatives, rather than knowledge alone. Therefore, efforts should focus on making sustainable options more accessible, convenient, and easier to adopt.

To encourage sustainable practices among this cluster, academic institutions should consider implementing certain incentives – such as access to designated travel funds and related privileges (e.g., travelling first class, recognition of longer travel times within working hours) – for those who opt for more environmentally friendly modes – such as train over flights – even when the travel time may be longer. Furthermore, institutional travel booking systems should default to low-carbon options whenever possible, requiring justification for selecting higher-emission alternatives.

For the "Performance-oriented academics" cluster, a shift in work culture seems required to foster behavioural change, given their attitudinal characteristics. This transformation should build on their strong sense of ethical responsibility in academia, aligning sustainability with the professional and moral obligations that they already recognise. A major challenge in this context lies in the generally prevailing narrative within academic institutions, which suggests that a reduction in travel could harm science as well as hinder individual scientific progress (Nursey-Bray et al., 2019). This view – widely endorsed by many academics – emphasises the value of in-person participation in conferences and other activities as a means to strengthen one's CV, enhance professional visibility, and ultimately improve prospects for career advancement. In our sample, approximately 70 % agree that "attending conferences is necessary for professional development and progression within the university sector". The same figure rises to nearly 95 % among "Performance-oriented academics". As a result, even those academics who express concern about their climate impact may hesitate to limit (or even avoid) travel due to fears of adverse professional consequences.

One potential way forward here pertains to rethinking the indicators that define "good" academic work. Aligning the goals of "successful" work and travel reduction at the institutional level could help reshape perceptions and prevent individuals prioritising sustainability from facing career disadvantages. This re-definition would, in turn, contribute to the creation and establishment of new social norms that support environmentally conscious academic habits. Additionally, institutions should actively promote role models by highlighting testimonials from respected academics who successfully integrate lower-mobility approaches into their practices without compromising their professional growth. Showcasing these examples could foster the normalisation of sustainable choices, challenge the assumption that frequent travel is essential for academic advancement, and encourage a broader adoption of responsible

behaviours. Within this framework, it should also be acknowledged that institutions often face a duality: while they aim to promote lower-mobility practices in line with sustainability goals, they continue to value in-person engagement as a key source of visibility, networking, and international impact, among other benefits (Storme et al., 2017; Wenger et al., 2025). Recognising this tension is crucial, as it underscores that institutional strategies cannot be limited to rhetorical support but must also involve a broader cultural shift in how academic life is conceived and how performance and impact are ultimately assessed.

Lastly, "Flight-shamed academics" stand out among the identified clusters for their strong commitment to environmental sustainability and social responsibility. Unlike the other two groups, they seem already aware of the environmental impact of conference travel and might experience social pressure to adopt "greener" behaviours. However, despite their motivations, a gap persists between their environmental attitudes and their actual intentions and conducts: recall that only a small minority within this group actively seeks to reduce their travel. In some cases, institutional barriers might further contribute to this inconsistency. Efforts targeting this group should aim at supporting their dedication to sustainability while ensuring they remain professionally competitive and well-integrated within the academic community.

To advance sustainable travel practices among these individuals, institutions should cultivate an academic culture that frames low-carbon travel as both an ethical obligation and a professional standard. This could be achieved by formalising and strengthening sustainability commitments at the institutional level through initiatives such as internal carbon budgets, mandatory carbon reporting for academic (long-distance) travel, and dedicated funding for low-carbon alternatives, among others. Additionally, increasing the visibility of these initiatives through awareness campaigns could serve to highlight best practices and emphasise the collective impact of reducing mobility. Reinforcing social norms – by publicly recognising departments or individuals who exemplify "green" habits – could further validate and encourage lower-carbon behaviours. Crucially, ensuring that sustainable travel choices do not result in professional disadvantages is essential for driving long-term behavioural change and enhancing the legitimacy of sustainable academic practices.

As discussed in Section 2, while face-to-face exchanges continue to be the dominant mode of academic engagement, virtual and hybrid participation are increasingly recognised as promising alternatives that could support more sustainable behaviours within academia – particularly when appropriate and under specific circumstances. Attitudes towards in-person activities appear to be relatively similar across the three identified clusters. Nevertheless, "Performance-oriented academics" place the highest value on physical presence, followed by "Low-concerned academics", and then by "Flight-shamed academics". Consequently, members of the latter group seem the most likely to embrace virtual or hybrid conferences. Given the potential of these models to reduce academic travel, a critical question arises: how can institutions effectively integrate them into academic practice? To facilitate this transition across our clusters, we propose three strategic measures.

First, institutions should embed the formal recognition of virtual and hybrid models within their organisational culture. Given academia's long-standing emphasis on physical interaction, it is essential to ensure that online participation is regarded as equally valuable as in-person attendance. This shift would not only legitimise virtual participation but also foster a broader commitment to environmental responsibility by challenging the prevailing notion that frequent travel is essential for career advancement. Such a

Table 6
Strategic lines of action to encourage more sustainable travel behaviours within the academic community.

Areas	Strategic lines of action	LC-1 Low-concerned academics	LC-2 Performance-oriented academics	LC-3 Flight-shamed academics
Promote sustainable choices	Providing certain incentives for low-carbon travel – such as access to designated travel funds, and related privileges (e.g., travelling first class when choosing for the train[a], recognition of longer travel times within working hours when opting for low-carbon modes).	√		
	Defaulting to low-carbon options in institutional booking systems, requiring justification for selecting higher-emission alternatives.	√		
	Formalising and strengthening sustainability commitments at the institutional level.			√
Redefine academic culture	Rethinking the indicators that define "good" academic work to align success with sustainability.		√	
Raise awareness and strengthen institutional engagement	Promoting role models who have successfully integrated lower-mobility approaches into their practices without compromising their professional growth.		√	
	Reinforcing social norms by publicly recognising departments or individuals who exemplify "green" habits.			√
Support online participation (virtual and hybrid models)	Embedding the formal recognition of virtual and hybrid models as viable alternatives to in-person activities within the cultural frameworks of institutions.	√	√	√
	Allocating resources to developing advanced digital infrastructure, ensuring seamless virtual participation.	√	√	√
	Providing incentives to encourage online participation (e.g., internal awards, carbon-offset grants).	√	√	√

[a] The suggestion to consider "travelling first class when choosing the train" warrants careful consideration in the context of equity in academic mobility. Such incentives should therefore be approached with caution, ensuring that equity considerations remain central to any policy discussion on sustainable academic travel.

change would support the credibility of online involvement while promoting sustainability within the academic community.

Second, institutions should require all conferences to offer options for non-physical participation, establishing high-quality virtual and hybrid formats as the standard rather than the exception. This shift would help support that limited travel does not compromise academic engagement but rather enhances inclusivity by broadening access for academics, particularly for those individuals facing financial, geographical, visa-related, or caregiving challenges. To facilitate this transition, resources should be allocated to developing robust digital infrastructure that ensures seamless virtual participation.

Lastly, institutions may introduce incentives to encourage the adoption of these alternatives, such as internal awards for sustainable conference participation, priority access to research funding for low-carbon travel choices, and carbon-offset grants, among others.

Building on the discussion above, we map a range of recommendations drawn from the existing literature aimed at fostering more sustainable travel practices within the academic community. These recommendations are then adapted and tailored to the three empirically identified clusters as strategic lines of action (Table 6), thereby providing guidance for policy design and offering more targeted and actionable insights for institutions.

The diverse cluster profiles underscore the heterogeneous nature of academics' motivations for conference travel, encompassing environmental concerns, opportunities for the academic community and science, enjoying travelling, individual performance, the significance of face-to-face exchanges, social norms, and ethical responsibilities. Understanding and recognising this diversity is instrumental in tailoring effective policies that acknowledge and accommodate the multifaceted array of factors influencing decision-making, while fostering a transformative shift towards sustainability in academic practices. Such an approach could help mitigate the risk of marginalising certain groups of academics through exclusion or misinterpretation, and supports the development of policies that are widely endorsed within the academic community. Overall, a crucial step in promoting sustainability across academia lies in aligning institutional policies with sustainability goals.

6. Conclusions

In this study, we identify three clusters of academics according to their motivations towards conference travel. To achieve this, we first determine the key factors associated with this professional practice and develop a set of attitudinal items to assess them. These items are subsequently presented to a sample of the Spanish academic community, yielding a total of 245 completed responses – a valid sample size for the purposes of this research (Nylund-Gibson & Choi, 2018; Weller et al., 2020). We then perform an EFA, a CFA, and a LCCA as data reduction and clustering techniques. Finally, we outline a series of policy recommendations tailored to each of the identified academic profiles across four key areas: promoting greener choices, reshaping academic culture to normalise lower-carbon practices, raising awareness and strengthening institutional engagement, and supporting online participation. Taken together, our findings provide a basis for advancing more sustainable academic mobility. At the same time, the study presents certain limitations that open up opportunities for future research.

Firstly, future investigations should consider expanding the sample to include a broader range of countries. This would enhance the applicability of the findings and facilitate cross-cultural comparisons within the international scientific community. Future research could also benefit from incorporating perspectives from other academic disciplines. Furthermore, our analytical approach could be applied to other professional sectors in which work-related long-distance travel plays an important role, including corporate business, policy-making, or global non-governmental organisations.

Secondly, future research on academics' travel behaviour could incorporate additional explanatory variables. On the one hand, exploring further attitudinal dimensions (e.g., aversion to change, career ambitions, or technological confidence) could provide deeper insights into academics' motivations. On the other hand, considering external factors – such as institutional policies, funding availability, career advancement mechanisms, and the geographical distance between academics' location and conference venues – could offer a more comprehensive understanding of the key drivers influencing travel decisions. In addition, future studies could investigate the trade-offs between environmental concerns and career imperatives. This area is of particular interest considering the ongoing efforts to promote more sustainable academic practices without compromising professional development.

Thirdly, future research could broaden its scope to examine other types of academic mobility beyond conference attendance. While our study specifically focused on conference travel due to its significant environmental impact and well-documented role in academic careers (Storme et al., 2013; van Ewijk & Hoekman, 2020; De Vos et al., 2024), a more holistic assessment of different forms of academic mobility – such as participation in international project meetings, research exchanges, and fieldwork – would provide a more complete picture of how academics engage in travel and its implications for sustainability.

Lastly, it is important to acknowledge that attitudes and behaviours are not necessarily well-aligned. Since this study focuses on attitudes, it does not allow for conclusions about whether these attitudes will translate into tangible behavioural changes or whether established habits will persist. This attitude-behaviour gap is best tested through real-world initiatives that offer empirical evidence.

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CRediT authorship contribution statement

Iria Lopez-Carreiro: Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Data curation, Conceptualization. **Oded Cats:** Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Data curation,

Conceptualization.

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.

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Data availability

The data that has been used is confidential.

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