How organizational constraints undermine sustainability actions in a university's campuses: A case study

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ABSTRACT

Higher Education Institutions frequently struggle between the urgency to advance toward more sustainable campuses and the slow pace of their transformation. Although several stimuli and barriers are identified in the scientific literature, difficulties persist as several actions commonly assumed as best practices demonstrate to fall short of planned goals. Findings in the literature are generic, lacking the identification of concrete aspects which affect the effectiveness of strategies. This work contributes to filling this gap. Driven by the aim to understand this phenomenon in the University of Coimbra, a case study approach was adopted and a qualitative method was carried out with all key players to map the decision-making process and understand how strategies in the areas of energy and buildings on campus are implemented. Findings revealed the consequences of approaching sustainability through the implementation of isolated technical solutions without an integrated strategy or a sustainability-based institutional culture. Significant organizational constraints, such as the lack of internal cooperation and communication together with rigid procedures, undermine practices on campus energy and buildings operations, previously misconceived as financial or technical barriers. Despite the existence of literature discussing organizational barriers, the extent to which they may interfere with the technical performance of energy-efficient systems and buildings is a novel disclosure. By showing how unveiling specific problems that need to be overcome may support the construction of adequate internal policies, help decision-makers optimize sustainability actions, and encourage a better use of resources and know-how, this study's approach and findings can provide useful insights to this and to other universities struggling with similar challenges. Thus, more case studies are recommended to compare outcomes at different levels – geographical, socio-economic, and technical – and contribute to comprehensive models for sustainable campuses.

1. Introduction

The potential contribution from Higher Education Institutions (HEIs) to slow down the known reaching of planetary boundaries (Rockström et al., 2009) is decisive yet underestimated. Ironically, the *alma mater* of knowledge is simultaneously the place where sustainability as science is shaped in a living laboratory (Victor et al., 2018), and where a set of large and complex built spaces with significant influence on urban surroundings and city life (Gu et al., 2019) consume energy and resources.

The efforts to engage in more sustainable practices are not new, especially in managing campus facilities, known as *operations* (Amaral et al., 2020). Economic savings are the most visible result, and the educational role and the pressure to lead by example encourage HEIs to embrace new goals in terms of sustainable development (United Nations, 2015).

To understand how sustainability can be stimulated or hindered on university campuses, studies suggest funding, resources, or administrations' support as the most relevant encouraging (or deterring) factors (Wright and Wilton, 2012). The same are suggested for the field of operations, namely for energy efficiency in university buildings and campuses (Hopkins, 2016; Leal Filho et al., 2019b; Maiorano and Savan, 2015). These findings are important since they may influence HEIs in decision-making. However, the literature does not fully grasp why sustainability on campus is so hard to achieve, set goals are still difficult to materialize (Eisenack et al., 2014), and some actions commonly perceived as *good practices* reveal to be unsuccessful (Amaral et al., 2021).

An exemplary case is the University of Coimbra analyzed in this paper, hereinafter referred to as University. Despite the declared commitment to sustainability and the good results reached in international rankings, this institution is struggling to achieve its goal of carbon neutrality by 2030. Thus, underlying factors must be undermining efforts or what is generally accepted as needed by the academic community. This leads to questioning whether the findings described in the scientific literature provide enough answers or the most accurate insights to guide decision-makers in designing appropriate sustainability policies and strategies.

Numerous studies focused on stimuli and barriers surveyed the perceptions of members performing the same functions in different institutions, directing the analyses only to leaders (Wright and Horst, 2013), staff (Sammalisto et al., 2015), or students (Dagiliūtė et al., 2018). However, those studies using quantitative methods denote low response rates (Leal Filho et al., 2019a, 2019c), biased samplings (Leal Filho et al., 2019d), and discrepancies between the public verbal concern and the actual actions in practice (Sousa et al., 2020). Despite these limitations, which affect the representativeness of the results, there is a tendency to generalize them. By contrast, literature on specific and empirical cases is still scarce (Fissi et al., 2021), especially on how those generic barriers may suit each HEI context.

Although the perceptions of people in the same positions provide a cross-cutting overview of common difficulties, it is expected that experiences from diverse elements in the hierarchy of the same institution offer different insights over the same challenges and, eventually, unveil issues which escape other members of the community and the literature. Substantiating this standpoint, some authors suggest that complementary perspectives to quantitative methods could be explored (Adams et al., 2018; Sammalisto et al., 2015). Furthermore, characterizing an institution based only on perceptions is different from basing it on implemented instruments and processes while assuming perceptions as a complement to the characterization.

In this sense, this article proposes to fill this literature gap by assuming a case study approach to explore the University's pathway through the environmental dimension of sustainability. Pursuing the objective of identifying effective ways to overcome the environmental drawbacks of the University, this work aims at understanding the reasons for such difficulty in achieving planned goals. In order to meet this aim, the following specific objectives were drawn:

- To map the processes of planning, selecting, and implementing sustainability actions within the organizational structure of the University;
- To identify the drivers and barriers to the success of actions in energy and buildings on campus;
- To move beyond *what* they are, by understanding *where* and *why* they happen in the built organizational map.

To this end, this work carries out a *vertical analysis* – a qualitative method applied to individuals who perform different functions in a single HEI. This approach differs from the abovementioned studies, which performed *horizontal analyses*, *i.e.*, surveyed respondents' concerns at the same hierarchical level in several HEIs.

In this case study, the experiences of all those involved in putting sustainability actions into place within the University's campuses were examined, particularly in the areas of energy and buildings. The decision-making and implementation processes were mapped through semi-structured interviews, and the challenges these key players face were analyzed. To better understand the ecosystem in which the actions arise, a series of questions related to the motivations and objectives of the actions were asked, whether they were continued or isolated, and if and how they found institutional acceptance.

The interviewees' descriptions allowed the construction of a roadmap of the existing actions towards sustainability on campus, the sequences and relationships generated, and the associated meanings that,

together, constitute the institutional workflow. Substantial different perspectives on the same actions were found according to the level of the organization hierarchy – top, middle, and bottom.

The analysis of the interviews unveiled an unprecedented demonstration of the consequences of moving towards sustainability through the adoption of technical solutions on campus without a governance or organizational transformation. The potential to reduce energy consumption and increase the energy efficiency of buildings is compromised by an institutional culture and work methods that are not adjusted to incorporate sustainability in practice.

Thus, this article debates the need to understand sustainability holistically. Sustainability on campus operations may occur without connection to the organizational functioning (Niedlich et al., 2019), particularly when isolated actions are triggered and executed locally. These actions are essential, yet raise the question of whether an HEI adopting sustainability practices may be considered sustainable. The answer may be in understanding organizational aspects and their exact role on the impact of such disparate actions as increasing renewable energy systems on campus or improving buildings' energy performance which literature has yet to disclose (Sovacool et al., 2015).

It is known that organizational aspects may affect the sustainability performance of institutions. However, in the field of sustainability in HEIs, the concrete identification of specific organizational barriers, where they happen, and especially, what impacts they may have on the actions adopted have not been properly demonstrated yet. In this sense, this article intends to contribute scientifically to the knowledge that feeds the construction of the most adequate and effective sustainability policies and strategies for each HEI.

2. Methodology

To understand the status of sustainability at the University, the research process has an exploratory nature and began with a preparatory characterization of the case study through a content analysis, namely on how the University incorporates sustainability in its diverse forms and activities. To this end, sources including the University's Statutes (Ciência Tecnologia e Ensino Superior, 2019), Strategic Plans and their Monitoring Reports (Universidade de Coimbra, 2019; 2016, 2011), Sustainability Reports (Coimbra, 2020, 2021) and the official website (https://www.uc.pt/en/sustainability) were used.

The collection of data to characterize the institution allowed the assessment of the most generic issues from a macro perspective. However, exploring the decision and implementation processes became limited. Moreover, from an operational point of view, despite the targets and actions established and designed in strategic plans, the monitoring plans show low accomplishment rates, particularly in decreasing the energy consumption in buildings. These characteristics make the proposed work even more significant, being an important basis for a more in-depth analysis which was carried out afterwards.

The mapping of the institution's internal organization allowed to surgically identify the key people of crucial importance in the decision-making and implementation processes, a procedure that Maxwell (2013) would call *purposeful sampling*. Ten selected elements – experts at the three levels of the hierarchical organizational structure (top, middle, and bottom) with high involvement and an advanced level of knowledge in the field allowed to address the main objectives of the interviews: (i) to reconstitute the process of planning, selecting, and implementing sustainability actions; (ii) to know the status of the University in light of its goals; (iii) to determine the existence of challenges or difficulties; and (iv) to understand their type and nature. Thus, a qualitative research method was applied through a round of semi-structured interviews with nine of the ten key people who agreed to participate. These were distributed across the University's organizational structure as (a) two elements from the top management team (Interviewees #1 and #2), one of which with experience in the management of an organic unit and, therefore, also considered to be part of middle level; (b) two elements

from the technical staff – middle structure (Interviewees #3 and #4); (c) four professors who self-identify with the bottom level (Interviewees #5 to #8), one accumulating duties in the management of an organic unit, and therefore, also considered as part of middle level; and (d) one element with accumulated experience throughout his/her career in the three levels of the hierarchy (Interviewee #9). The respondents' areas of expertise are broad, ranging from planning, economics, and law, to the predominant extent of campus operations such as energy, buildings, and transportation (Supplementary Material, Table 1).

Open-ended questions were based on the interviewees' experience and perspectives of sustainability activities within the University – from the decision-making to monitoring phases – and their involvement and cooperation with other elements. At the end of each interview, respondents were asked to provide their perceptions on the general status of the University's sustainability and to list the drivers and barriers to becoming a sustainable campus. In order to compare responses in the data analysis phase, most of the questions related to this latter subtopic were similar for all respondents. The interviews took place mainly online – via Skype and Zoom due to the pandemic situation of COVID-19 – and were prepared to last between 30 and 90 min. The interviews were audio-recorded after obtaining the informed consent of all the interviewees, and the collected data was anonymized and organized. The recordings were then transcribed and coded through the qualitative data analysis software MAXQDA 2020. This software was used due to its convenience, as it was one of the tools available in the research unit and for which the researchers had training.

To better understand how the presented findings were reached, the Supplementary Material provides an overview of the groups of questions, examples of responses according to each hierarchy level, and the codes these generated. Grounded theory (Charmaz, 2006; Patton, 2015) was adopted, starting from scratch to draw meaning and create a narrative around the obtained responses.

Strategies to validate the conclusions were inspired by Maxwell (2013), namely those to avoid researchers' bias and validation threats (*e.g.*, long-term observation, searching for discrepant evidence, and comparison). The structuring of the work process also followed most of the recommendations proposed by O'Brien et al. (2014), particularly the content which feeds the main parts, the problem formulation, the description of the method, and even the discussion of the outcomes.

According to Lune and Berg (2017), a qualitative approach is particularly appropriate to obtain in-depth information on a little explored phenomenon. Moreover, semi-structured interviews provide freedom to lead the interview into areas that stand out throughout the conversations while allowing for comparison between answers to key questions. These may either be used to analyze the national panorama on sustainability practices (Santos, 2017) or for the Education for Sustainable Development from a governmental point of view (Farinha et al., 2018),

Qualitative research was also chosen since it focuses on words rather than quantifying, underlining an inductive approach (Bryman, 2012). In contrast to quantitative methods, which aim to test theories, qualitative methods are theory generators. The convenience, or purposeful sampling, is a limitation of the method for generalizing conclusions (Farinha et al., 2018). However, the most challenging concern is purging researchers' pre-conceptions when designing the questionnaire (Newman, 2004). Even so, the findings provide rich evidence which is a valuable contribution for a thorough understanding of a theme (Patton, 2015), as it goes beyond the *what* questions to seek for a deeper *why* interpretation ("Powers of qualitative research," 2022).

3. Findings

3.1. Institutional framework

The content analysis revealed that, from top to bottom, the University incorporates sustainability in its mission and responsibilities statements. Hence, strategic plans are designed to reflect the goals of the University's activities in all the sustainability dimensions for the four years of the rectorate's term. They are further developed in several action plans. In addition, a technical department under the umbrella of the administration is responsible for implementing the outlined goals at the building and campus levels. In parallel, the academic community carries out courses, research, and academic work in the field of sustainability in general and on the sustainable campus in particular. The University under analysis may be considered a large-sized institution according to the QS classification (QS Quacquarelli Symonds, 2022), and has three campuses with very different construction periods and typologies – education, research, libraries, auditoriums, dormitories, restaurants and services – which make them good candidates for a study model.

3.2. Interviewing process

Throughout the interviewing process, underlying factors unexpectedly emerged from the interviewees' discourse when reporting events and activities, which allowed to detect positive and negative aspects far beyond the drivers and barriers listed. Therefore, they were coded as "Facilitators" and "Difficulties" throughout the data analysis process, respectively. These have enriched the theory around the pieces that can affect the process, either positively or negatively. In this sense, two perspectives were adopted within the positive and negative aspects:

a) The pessimistic perspectives are listed under the codes "Difficulties" and "Barriers" (Fig. 1). The first category lists those aspects revealed by the reports of events or people who, directly or indirectly, intervened in the implementation of actions. The second relates to the barriers identified by the respondents when directly asked which they considered existed.
   b) The optimistic perspective includes the codes "Facilitators" and "Drivers" (Fig. 2). The "Facilitators" encompasses the reports of events or individuals who facilitated the implementation of actions. The "Drivers" category lists the key inputs identified by the respondents when asked directly which they considered existed.

This dissociation is relevant since it was noticeable that, in most cases, the identified drivers and barriers did not coincide with the reported facilitators and difficulties, respectively.

The process of implementing actions on campuses described by the interviewers was unanimous. The main sustainability initiatives on the University's campuses – which otherwise, feed the institutional strategy – have been mainly driven by the interviewees and their fields of work, knowledge, and addressed responsibilities. These include their involvement in education for sustainability, campus and facilities management, and institutional strategic planning or leadership (Supplementary Material, Table 1). Moreover, bottom-level interviewees revealed signs about the status of the University's built environment. For example, those who accumulated managerial and teaching functions were driven by problems identified in the physical space to develop further work.

From a technical point of view, actions to improve the performance of buildings or the energy management on campuses must be executed through the technical services of building management. Here, major interventions in buildings and outdoor spaces are planned, for which the design and construction teams must be often outsourced. However, no follow up is scheduled to verify if building systems are functioning properly. As Interviewee #5 pointed out, *"These buildings are handed over to the owner, but the owner is a more or less an abstract entity that is the University."* There are often non-conformities and/or inadequate schedules in technical and energy management systems, leading to savings below the expected. The lack of specialists within the technical staff to supervise the systems' operation and maintenance leads to their misuse. The same interviewee also claimed, *"Department C did not even know that it had a technical system* […]. *So, we realized that its parameters*
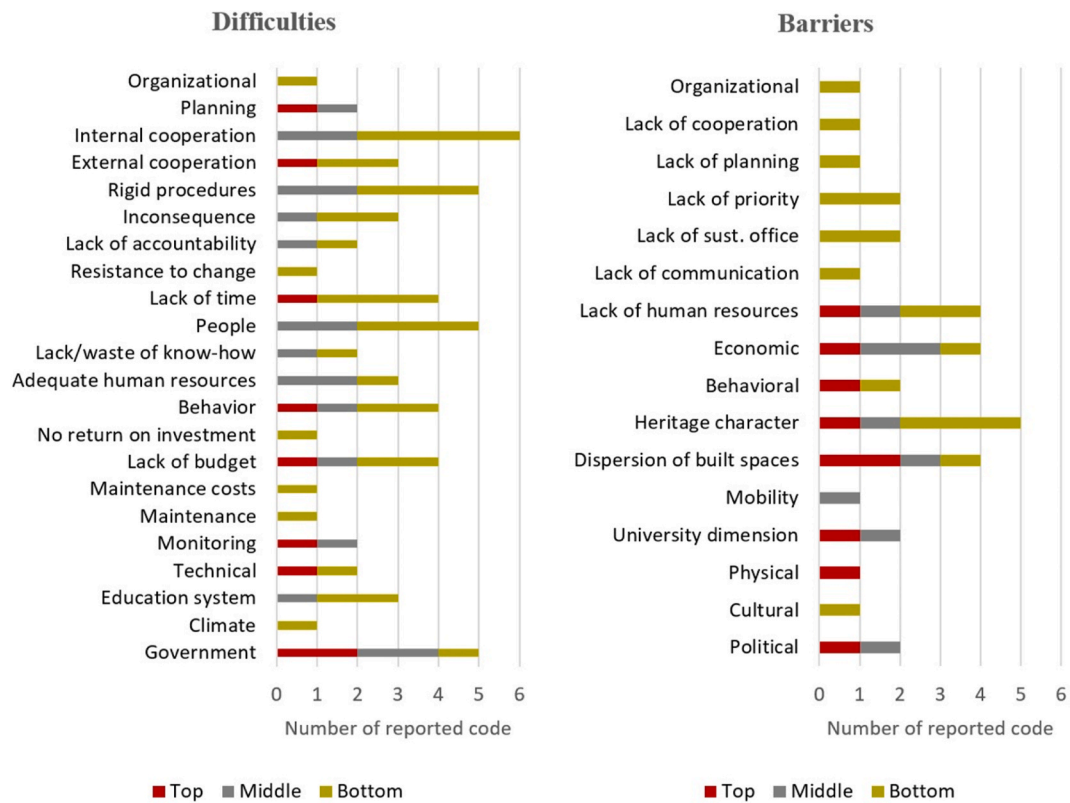
Fig. 1. "Difficulties" and "Barriers" emerged from the interviews, distributed by the Institution's hierarchy.
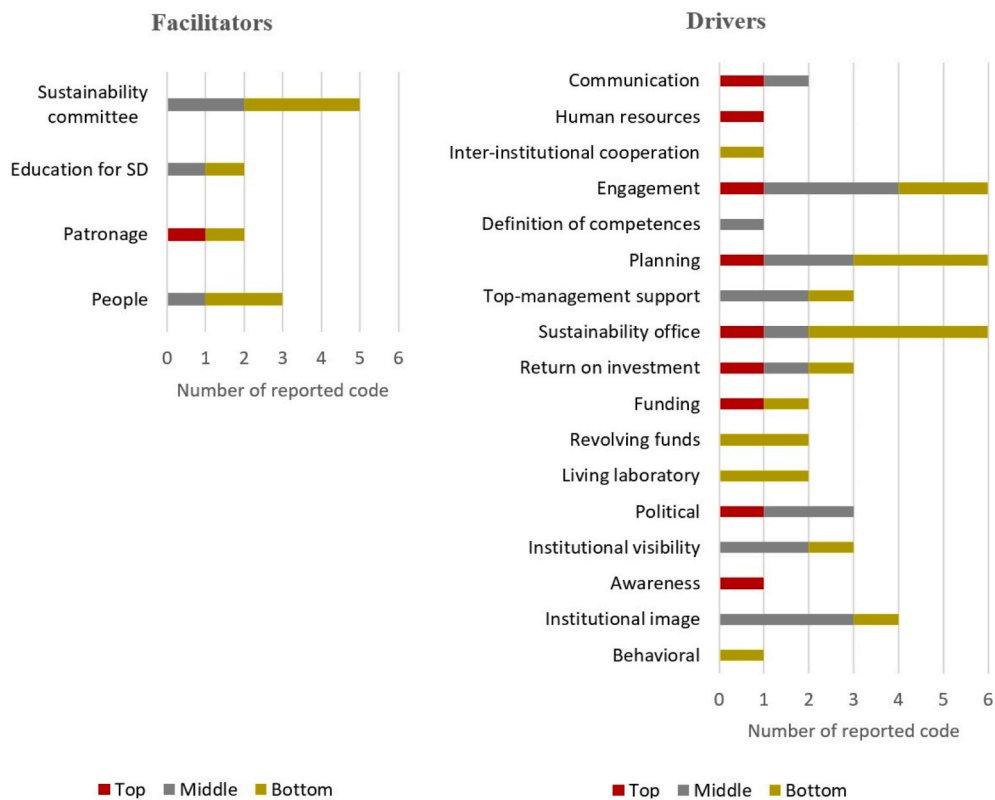

Fig. 2. "Facilitators" and "Drivers" emerged from the interviews, distributed by the Institution's hierarchy.

were poorly programmed […].'' Thus, the improvement of the buildings' performance depends on the technical knowledge of its users, namely professors and directors.

Although every individual has the autonomy to propose sustainable solutions, they must be implemented by the technical department after following a generic administrative procedure. This practice is similar to any purchase order carried out at the University, which is time-consuming and bureaucratic. Therefore, some interviewees were discouraged from advancing with more proposals due to such a rigid process.

Moreover, the inability to react to all requests has deterred technical staff from doing more than just responding to superior instructions. Interviewee #3 explains, *''*[…] *It is worth mentioning the difficulty in retaining technicians to carry out both the implementation of the measures and their monitoring.''* The interviewee continues, *''We do not have enough records to make this detailed assessment, resulting from multiple factors such as the* […] *scarcity of resources.''*

The 'monitoring' is based on reading energy and water meters and bills, and the data is not used to build or follow-up on strategies for reducing consumption. Some interviewed professors acknowledged the existence of mechanisms for consumption monitoring which have not been properly used, nor have they been operating at their full potential. For instance, Interviewee #5 states, ''[the monitoring system] *is mal-functioning and, in some cases, it is buggy; it is producing data that nobody looks at.* […] *There is a system with 20 or 30 meters* [collecting] *data to a database that almost no one knows it exists.''* On the other hand, according to a top-level interviewee responsible for installing photovoltaic systems, measurement and verification procedures to determine follow-up actions do exist. However, the technical services have a different vision and do not monitor the implemented actions, which undermines their purpose.

The same is experienced in the maintenance of existing systems. Interviewee #5 acknowledges, *''*[the institution] *has already lost some* […] *tens of thousands of euros with the photovoltaic systems because no one looks at them.''* Therefore, the maintenance schemes remained undefined, assuming that such responsibility lied with each organic unit. Those whose field of knowledge fall outside the environmental and energy scope cannot respond to these demands since energy systems require specific skills.

When questioned about the existence of a budget for implementing measures, bottom-level respondents were unanimous in stating that they do not have direct or dedicated funding for implementing actions. Instead, funding is obtained from the general budget of each organic unit and is defined by whomever manages it. Concerning existing governmental funding programs for improving energy performance in public buildings, the technical service staff is unaware if or when the University had ever applied for any, even though the eligible measures fall within their responsibilities. Interviewee #3 reported *''The University has its own services to analyze and apply for funding programs. I do not know if they have taken advantage … going through technical service, there has been no such use.''* This lack of accountability and internal communication between departments leads to the disuse of existing financing programs. Interviewee #3 also highlights the lack of adequate human resources to evaluate and prepare applications for funding programs related to energy efficiency measures in buildings: *''Even because we do not have technicians capable of evaluating* [the applications], *we have not embraced projects in this area, at least not recently.''*

Among the economic difficulties exposed, some interviewees point out the lack of internal return on investment, since there is no practice of rewarding or split incentives. The savings generated by sustainability actions in energy and buildings return to the institution's administration and not to those departments who carried out the investment. When distributing annual budgets, the savings are not visible, and this practice is seen by Interviewee #5 as a demotivating factor.

When questioned about their involvement in the organizational structure, in the cooperation or contribution to the decision-making or planning process, all the bottom-level interviewees stated they were not involved. From the point-of-view of those in top positions, interviewees transmitted an optimistic perspective of the existing cooperation processes. However, when descending in the hierarchy, interviewees reported a theoretical receptivity, but in practice, it does not occur. As Interviewee #9 explains, *''Those* [works] *that had to do with diagnostic studies, with pointing out solutions, we used to deliver these conclusions to those responsible* [in the] *Administration structure* [… and] *to the technical service.* […] *And I would say that there are constraints.''* Within the academic community, there is no clear internal communication or dissemination of strategies, objectives, or even what is expected from the elements of the organization. Those responsible for implementing concrete measures revealed that the community does not know the impact of their activities. Interviewee #3 acknowledges that despite knowing there is a sustainable campus concept, *''it is noticed at the top of the structure and … I think this concept has not reached yet the bottom.''* and understands it is *''essential for people to be aware of the impact their activity has on the sustainability of the University* […].*''*

Interviewees at the top level unveiled fewer difficulties (Fig. 1). They also felt that barriers occurred due to imponderables which were beyond the control of the institution, such as the physical structure of the University – namely the dispersion, dimension, and heritage character of the built spaces – or to systemic constraints, including political, regulatory, or governmental orientations.

Despite the increase in human resource recruitment, limited staff with adequate technical knowledge was identified and vastly perceived throughout the interviews in all three levels. Due to the lack of cooperation and engagement, the misuse of existing expertise with regards to faculty and researchers, was the difficulty most reported by all levels. Even when key factors are readily available such as internal knowledge or a dedicated budget, the lack of involvement and cooperation has been critical for the university's successful sustainability transition.

People may exert an obstructive effect but also a facilitating one (Fig. 2). In the latter case, interested individuals within the academic community have been promoting impactful actions, such as installing photovoltaic panels with external funding through patronage. This behavior has been decisive in implementing such an important energy strategy.

The difficulties experienced gave rise to suggestions of stimuli to move positively towards more sustainable campuses. Most bottom-level respondents argue that creating a sustainability office is the most important driver, followed by the need for an integrated plan, given the fragmentation with which actions have been treated. This suggestion stemmed from the need to engage all people involved and create an integrated and effective planning scheme.

4. Discussion

Hearing the different perceptions of the difficulties experienced and the facilitating factors has distanced this work from the economic or resource problems which is generally disclosed in the literature. It has brought it closer to those which advocate attention to more organizational and human aspects. If interviews had been conducted solely for respondents to consciously identify the barriers and drivers, very different conclusions would surely have been reached, as Figs. 1 and 2 illustrate. However, the findings unexpectedly show the extent to which organizational constraints are the genesis of such distinct and important factors, as economic and technical, working in a domino effect. When mapping the identified encouraging or deterring factors through the institutional workflow and the sustainability decision-making process (Fig. 3), two aspects stand out: (i) the different perspectives according to the interviewees' functions/hierarchical levels, and (ii) the prominence of the organizational issues.

As with many other HEIs, according to Amaral et al. (2020), the actions adopted in the University's campuses are not driven by the national context in terms of resources consumption. Other specific studies
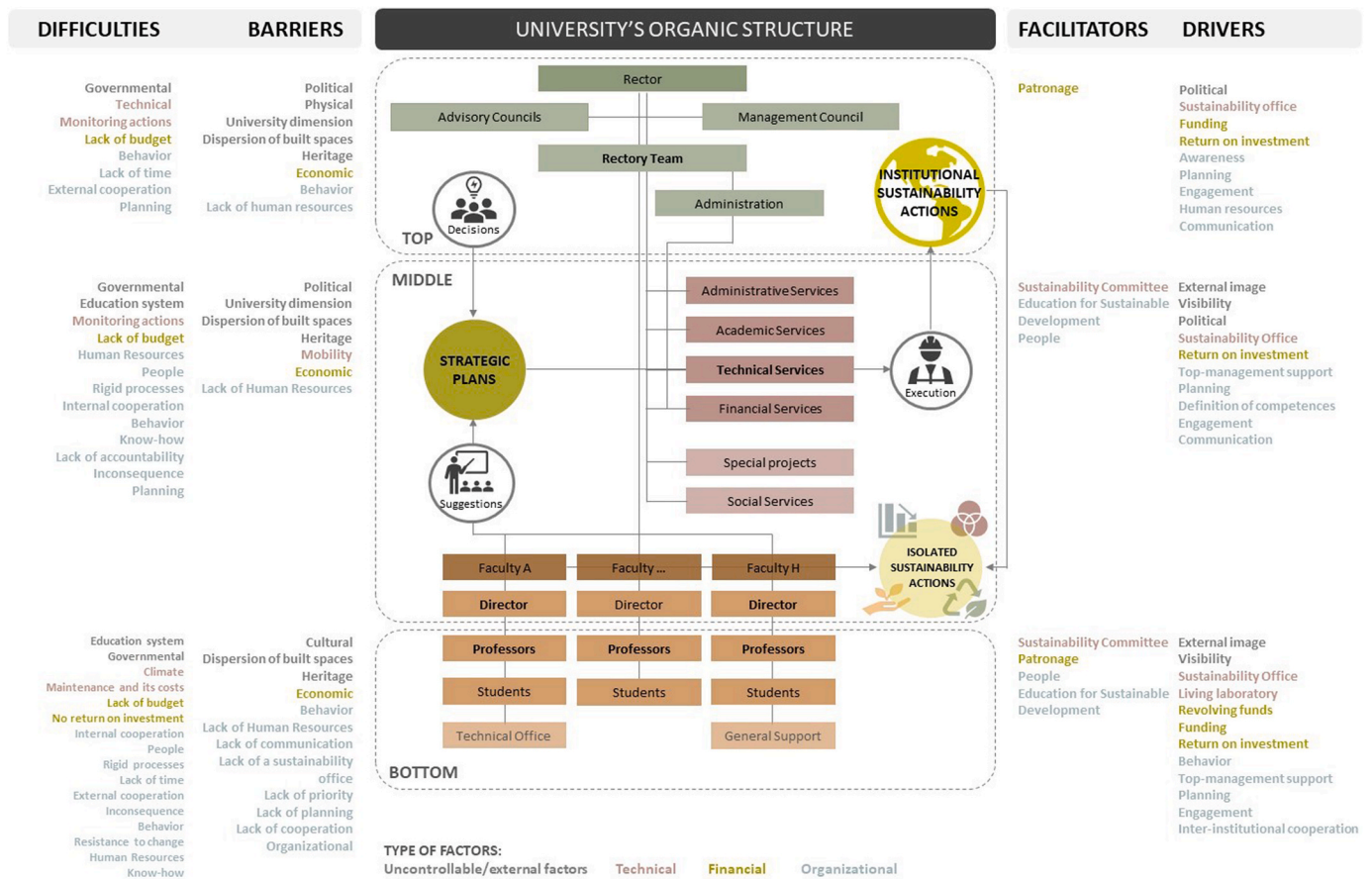
DIFFICULTIES | **BARRIERS** | **UNIVERSITY'S ORGANIC STRUCTURE** | **FACILITATORS** | **DRIVERS**

TOP

Governmental, Technical, Monitoring actions, Lack of budget, Behavior, Lack of time, External cooperation, Planning — Political, Physical, University dimension, Dispersion of built spaces, Heritage, Economic, Behavior, Lack of human resources

Rector — Advisory Councils — Management Council — Rectory Team — Administration — Decisions — INSTITUTIONAL SUSTAINABILITY ACTIONS

Patronage — Political, Sustainability office, Funding, Return on investment, Awareness, Planning, Engagement, Human resources, Communication

MIDDLE

Governmental, Education system, Monitoring actions, Lack of budget, Human Resources, People, Rigid processes, Internal cooperation, Behavior, Know-how, Lack of accountability, Inconsequence, Planning — Political, University dimension, Dispersion of built spaces, Heritage, Mobility, Economic, Lack of Human Resources

STRATEGIC PLANS — Administrative Services, Academic Services, Technical Services, Financial Services, Special projects, Social Services — Execution — Suggestions — Faculty A, Faculty …, Faculty H — Director, Director, Director — ISOLATED SUSTAINABILITY ACTIONS

Sustainability Committee, Education for Sustainable Development, People — External image, Visibility, Political, Sustainability Office, Return on investment, Top-management support, Planning, Definition of competences, Engagement, Communication

BOTTOM

Education system, Governmental, Climate, Maintenance and its costs, Lack of budget, No return on investment, Internal cooperation, People, Rigid processes, Lack of time, External cooperation, Inconsequence, Behavior, Resistance to change, Human Resources, Know-how — Cultural, Dispersion of built spaces, Heritage, Economic, Behavior, Lack of Human Resources, Lack of communication, Lack of a sustainability office, Lack of priority, Lack of planning, Lack of cooperation, Organizational

Professors, Professors, Professors — Students, Students, Students — Technical Office, General Support

Sustainability Committee, Patronage, People, Education for Sustainable Development — External image, Visibility, Sustainability Office, Living laboratory, Revolving funds, Funding, Return on investment, Behavior, Top-management support, Planning, Engagement, Inter-institutional cooperation

TYPE OF FACTORS: Uncontrollable/external factors — Technical — Financial — Organizational

Fig. 3. Simplified roadmap of the University's organizational structure, decision-making process and the underlying positive and negative factors identified.

for the Portuguese reality show that HEIs in this country build their own sustainability approaches as there are no governmental guidelines for the higher education sector (Aleixo et al., 2017; Farinha et al., 2020). These studies are in line with the abovementioned international literature focused on barriers to sustainability, and a horizontal analysis shows a national panorama characterized by the perception of a lack of funding for sustainability actions on campuses (Aleixo et al., 2018). The relegation of the environmental area to the background by prioritizing actions in the social dimension of sustainability (Aleixo et al., 2017) results in the adoption of isolated measures without a strategy (Farinha et al., 2020) and, consequently, an awareness of the benefits (or not) of the actions chosen.

The findings of this study show that the perceptions of the University's members with similar functions as the interviewees of the abovementioned studies are aligned. However, the institutional big picture framed by all the attained perceptions unveiled that funds exist – either local or national (Ministério do Ambiente, 2023) – but are unexploited due to the lack of internal cooperation, communication, and adequate human resources. These funding programs may be useless if an institution is unable to assess the most appropriate means to apply to them or obtain an optimized *initiative vs. impact* ratio. The lack of funding is assumed in the literature as one of the major barriers (Leal Filho et al., 2019c; Wright and Horst, 2013). Nevertheless, when considering the perspectives of more than one level, position, or sector of the HEI structure, one realizes that the constraints might not be exactly financial but rather the inability to capture existing funding programs. Since respondents on the top consider institutionally funding some sustainability actions, a strategy of revolving funds (Maiorano and Savan, 2015), where economic savings derived from energy initiatives are reinvested in further actions, can be a starting point to face the financial stigma. At this point, internal technical knowledge – which in

the case studied exists – can have an important contribution if called upon to assist decision-makers in studying the most appropriate actions for each case and goal.

Since this work aims to help the University achieve its carbon neutrality goals, the sustainability panorama was investigated through the lens of technical and operational solutions on campus. It was shown how key actions such as the maintenance or monitoring of energy and building systems are compromised. An example is an unawareness of control over the implemented actions and, consequently, the struggle to follow up and assess their impacts. This difficulty arises since the effectiveness of monitoring technical systems and maintenance depends on a structure's workflow that has not been shaped to deal with technical challenges. Carbon neutrality is highly dependent on reduced and clean energy consumption. However, solely adopting technology-based tools and methods, which should produce the most expressive economic and environmental benefits in the short term, may provide limited results if organizational problems are not resolved upstream or if a favorable ecosystem is absent. From a scientific perspective, it is not enough to recommend maintenance and monitoring of resource consumption and implemented actions. It is also necessary to define who, how, and when these are done. This understanding means that institutional workflow must be adapted to accompany the technical strategies to be adopted. Moreover, it must involve all the elements of the academic community towards accountability and not just awareness.

Another example is the strategic plans, mostly comprised by actions endorsed by enthusiastic individuals but without connection, coordination or an integrated viewpoint. When this happens, the territorialities and asymmetries within the institution are unavoidable (Hoover and Harder, 2015) since sustainability is encouraged where involved individuals are placed.

Although top management's support (or its absence) is seen as a

determinant for achieving sustainability goals (Ávila et al., 2017; Lozano et al., 2015; Ralph and Stubbs, 2014), institutional commitments are irrelevant if they are not translated into more concrete policies. Considering that the case study is an example of simultaneous institutional commitment and practical shortcomings, support *per se* is insufficient if top management is not involved. Support may only mean that initiatives are authorized. Therefore, the administrative bodies of HEIs should actively stimulate and exemplify behaviors and practices that induce sustainability. However, reaching individuals who have the authority in the change- and decision-making processes is a challenge that may only be overcome with the evidence of concrete benefits. This challenge is particularly important when decisions (or the lack of them) tend to be based on the perception of barriers as uncontrollable.

Actions on campus operations are the visible part of adopting sustainability practices; they represent the major contribution to achieving the needed rational use of resources to the relief of *planetary boundaries*. However, an HEI becomes sustainable when invisible boundaries are addressed through the transformation of a collective and individual mindset (Mader et al., 2013; Rieg et al., 2021). As a long-term process, it does not produce a visible and economically attractive result as renewable energy systems or efficient buildings (Newman, 2007). Nevertheless, it is the support for the success of those sustainable technical actions.

Changing the pattern of assumptions shared by and taught to members of an organization, which is perceived as well-working for solving problems, *i.e.*, the *organizational culture* (Schein, 1990), is one of the most challenging missions for an HEI. However, in a culture of sustainability, those shared assumptions and beliefs should balance environmental, social, and economic dimensions (Adams et al., 2018). The generalization of scientific production is difficult, given the complex and subjective ethos of sustainability (Di Lucia et al., 2022). Moreover, existing literature on organizational culture is still focused on productivity instead of sustainability, leaving a gap on sustainability-based organizational cultures research (Assoratgoon and Kantabutra, 2023).

For this reasons, literature focused on organizational change suggests recommendations and strategies rather than developing models, tools, or concrete solutions (Hoover and Harder, 2015). These approaches are few (Adams et al., 2018; Niedlich et al., 2019), and some are built upon acknowledging the local barriers (Verhulst and Lambrechts, 2015), drivers (Akins II et al., 2019), and circumstances (Barnard and Van der Merwe, 2016) as was done. Thus, their applicability to other cases falls on the process rather than on the results. For example, Newman (2007) outlines a three-step process for managing the change towards sustainability. This process is based on continuous progress assessment and the recognition of key characteristics, highlighting the need to be mediated by an individual or a team who must know and understand the organization's dynamic, the decision-making, and the operational processes. The importance of incorporating sustainability insights as a science (Pauliuk, 2020) and multidisciplinarity as a vehicle to embrace it (Hernandez-Aguilera et al., 2021) is evident here.

Organizational constraints may be of diverse nature, and an in-depth reflection on the governance models is important to surpass each HEI's shortcomings. Understanding implicit tensions (Hoover and Harder, 2015) or the interdependencies and contradictions between barriers (Eisenack et al., 2014) may help to overcome those repeated ones, such as the lack of engagement, accountability, or even territorialities. In fact, this can be one of the main missions of the much-suggested sustainability office, whose benefits literature recognizes (Leal Filho et al., 2019d). However, it may not be a *sine qua non* condition. Even the success of a sustainability office depends on the level of integration and aggregation capacity within the HEI's structure (Burger and Sherry, 2017). It must have an in-depth knowledge of the context and be prepared to act as a coordinator of the diverse players and overcome the existing weaknesses and challenges to the engagement of sustainability in the institution.

Regarding the particular case analyzed, this work fulfilled the initial

purpose of understanding what is at the origin of the slow transformation pace. In this sense, the importance of the case-studies approach is highlighted, since it represents the main limitation of this study – the analysis of a single case impedes the outcomes to be generalized.

5. Conclusions

The role played by university campuses is increasingly recognized in building more sustainable and resilient cities and communities. As such, the conclusions of this work have important implications. Their scientific contribution relies on the demonstration of how identifying and mapping concrete and specific drivers and barriers through the application of a different methodology may help decision-makers to be aware of internal issues that may influence the success of sustainability strategies or goals. Therefore, more similar approaches are suggested for other HEIs, including the methodology used that is appropriate to identify detailed features that may substantiate the construction of more general but solid policies and, thus, to build comprehensive models for sustainable campuses. Similar case study analyses would allow a comparison of identified drivers and barriers, and if these are specific to only some HEIs or common to many. They would also allow to find any relationship with local or national contexts, with socio-economic, technical or physical conditions of each HEI or, more important, if they are related to specific governance models or organizational cultures.

Foreseeing that HEIs are rooted in local conditions, there is no formula or a governance model for all those dealing with organizational problems. Every case should be analyzed and adapted to the cultural specificities to ultimately understand and solve the concrete problems each one faces. This deepening of particular cases is crucial for all those who work on or intend to start the arduous task of moving towards more sustainable campuses. Scrutinizing whether the barriers and stimuli found in a specific case coincide with those in the literature and how the encountered generic problems break down into more specific issues are tasks that confirm, refute or complement existing knowledge. Moreover, the findings of this work contribute to growing the awareness among researchers of the importance of a vertical perspective of institutions in decision-making processes, moving beyond the perception of only one representative. It also highlights the cruciality of analyzing every step involved in a sustainability action for its success – from planning to monitoring. Without these approaches, there is no certainty whether adopted practices are, in fact, *good practices*.

This study provides practical recommendations that can inform the analyzed University in particular and simultaneously inspire other HEIs when considering that all its institutional actions have an environmental impact. By identifying how indirectly related gaps impact technical solutions, it contributes to preventing failures and maximizing the efficiency in the use of resources, whether economic, human, or natural. In this way, researchers and practitioners can develop targeted strategies to improve campus operations, including implementing cleaner production methodologies.

In the case studied in this work, now that difficulties, barriers and also the stimuli are identified and mapped, a vast potential for improvement was opened; future work involves narrowing the carbon neutrality goal into a concrete path. In other words, the estimation of the University's carbon footprint through carbon footprint calculators, the definition of nearly zero-energy buildings or campuses' goals through a cost-benefit analysis, or the application of an environmental or energy management system as ISO 14001 or ISO 50001, are some strategic examples. However, considering the context found, the strategy to be adopted cannot neglect the internal constraints; thus, coupling the technical and the organizational fields of the decision-making process work is crucial to optimize the impacts of actions on campus operations.

In this sense, there is a need for a strategy that goes through a systemic, continuous, and holistic approach, even if this implies revising

the governance model, to help overcome the identified lack of engagement, cooperation, and communication between the involved parties. It must tackle all sectors of the institution's activities through flexible strategies capable to evolve and be grasped in an integrated sustainability planning. Furthermore, in cases demonstrating isolated actions, as the interviews showed, introducing a novel workflow dedicated explicitly to sustainability on campus operations, namely on energy and buildings, is an important area for further research. Acknowledging that this is a long process of transformation, learning, and continuous improvement, evidence suggests that it is the first step towards becoming a sustainable HEI rather than simply adopting isolated sustainability actions.

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CRediT authorship contribution statement

Ana Rita Amaral: Conceptualization, Methodology, Investigation, Visualization, Data curation, Writing – original draft. **Eugénio Rodrigues:** Conceptualization, Methodology, Writing – review & editing, Supervision. **Adélio Rodrigues Gaspar:** Writing – review & editing, Supervision. **Álvaro Gomes:** Writing – review & editing, Supervision.

Declaration of competing interest

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

Data availability

The authors are unable or have chosen not to specify which data has been used.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jclepro.2023.137270.

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