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Universities' Reporting on SDGs: Using THE Impact Rankings to Model and Measure Their Contribution to Sustainability

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Abstract: Higher education institutions (HEIs) have voiced growing concerns about sustainability issues since Agenda 2030 was approved, but this is not enough for societal stakeholders seeking and delivering innovation and excellence. The 17 Sustainable Development Goals (SDGs) were adopted by all UN Member States in 2015 as a universal call to action, and pose a challenge for HEIs as for the efforts made to fulfill them and knowing how to assess their performance. However, the metric management system implemented by HEIs quickly led to rankings emerging, which compare HEIs to metrics not related to the sustainability dimensions of the 17 SDGs. The main aim of the paper is to assess the level of reporting and alignment of SDG achievements with the overall the *Times Higher Education* (THE)ranking score. For this purpose, our study (i) models and quantifies the impact of HEIs' disclosure of SDG information on HEIs' overall THE Impact Rankings score, (ii) analyzes whether the best ranked universities are indeed significantly related to different SDGs than other not-so-well-ranked ones, and (iii) models the differences in the overall score and its alignment with distinct SDGs by dimensions, subjects, and geographical regions. In order to do so, a descriptive analysis, non-parametric tests, and linear and logistic regression analyses were performed. Our results reveal that the overall ranking is related to the reporting of HEIs' SDG achievements. Moreover, the more positive actions related to health, education, industry, responsible consumption and production, climate action, and partnerships there were, the higher the position of HEIs in the general ranking was. However, we found differences between top-ranking universities and others in geographical location, disclosed information, and impact. Thus, the best-ranked universities are more committed to transferring knowledge to industry to satisfy its needs (SDG9), support strong institutions in their countries, and promote peace and justice (SDG16). Finally, SDG9 and SDG17 are the most relevant and constant SDGs when modeling the alignment of SDGs with HEIs' dimensions (teaching, research, citations, industry income, international outlook) and subjects (technological and social sciences and humanities). HEIs integrating SDG actions into the strategic management of universities and, consequently, reporting their SDG performance to promote sustainability and contribute to sustainable development, is advisable.

Keywords: geographic location; higher education; linear regression; logistic regression; metric management model; sustainable development goals; university ranking

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1. Introduction

The Sustainable Development Goals (SDGs) came about in 2012 during the UN Conference on Sustainable Development in Rio de Janeiro. The objective was to produce a set of universal goals to meet the urgent environmental, political, and economic challenges that the world faced. World leaders adopted the UN SDGs in 2015. The 17 SDGs aim to end poverty, hunger, and inequality; take climate change and environmental actions; im-

prove access to health and education; and contribute to strong institutions and partnerships, among others, all by 2030. They are universal, over 190 countries are subscribed to them, and they apply to all countries and people [1].

These SDGs can be effective in communicating urgent priorities. In order to mobilize stakeholders' attention and participation, each goal contains several targets to be met by 2030. All goals are multidimensional, which means that each implies achieving different aspects, which are all related and interconnected. So their definition requires choosing measurement tools and indicators, which can only be selected when the questions, "What is measured?," "Who finances and does the measuring?," and "How are data collected, interpreted, and disbursed?" are answered [2]. They also require in-depth thought about fundamental issues on the power of data to shape knowledge control to not be bound by politics [3]. This shows that universities are important contributors to implementing SDGs, provide an invaluable source of expertise in research and education in all the SDGs sectors, and are considered neutral and influential players that foster the growth of partnerships with governments and communities [4].

Actions have been performed since the UN's agreement was reached in 2015 [5]. Many stakeholders from public and private sectors have embraced the SDGs by developing new instruments or partnerships. Higher education institutions (HEIs) are no exception. More than 300 universities have partnered with the UN to create a network called the Higher Education Sustainability Initiative [6] (Higher Education Sustainability Education). The International Sustainable Campus Network (ISCN) has published the best campus sustainability practices in its annual report since 2013 to show and promote sustainable development in higher education [7]. In the present day, universities keep signing declarations and agreements that do not result in changes while industry is increasingly held accountable for the impact of its activities on society [8,9].

Since the beginning of the 21st century, Western economies have shifted from a linear innovation model, in which the basic research invented at HEIs and industry have applied it with a one-directional arrow, to a nonlinear interactive paradigm, the triple helix model or knowledge-based economy, in which research, invention, innovation, and economic growth dynamically interplay among policymakers, HEIs, and industry [10]. Hence, universities have the capacity to generate, translate, and disseminate relevant transdisciplinary science [11] to fulfill the SDGs by engaging academic disciplines on the one hand and society's needs on the other, which does not necessarily match what society demands from universities [12]. SDG4 (quality of education) naturally fits universities' functions. However, SDGs are interconnected, and it is difficult to isolate education from fulfilling other SDGs. Thus, education is one of the pillars for implementing SDGs, and HEIs play a critical role in supporting and accelerating SDGs' success because of their research and education expertise across all SDGs.

Along these lines, [13] identified the four elements by which universities can boost the implementation of SDGs at the societal level: research, teaching, operations and governance, and community engagement. They are analyzed below.

Knowledge acquired in transdisciplinary research is based largely on empirical evidence, which consists of mathematically modeling both data and statistics. In line with this, recent research shows causal evidence for the impact of universities on local innovation and economic activity. Florida and Gaetani [14] highlighted universities' role as a key source of talent, and a key driver of innovation and economic growth, in a knowledge-based economy. These authors empirically analyzed the positive relation between the presence and size of local research universities and local patenting intensity in the USA, which increases for higher-ranking universities, particularly for subject rankings in engineering and sciences. In contrast, [15] argued that the influence of research universities on innovation systems beyond regional borders may be substantial, and leading research institutions do not discriminate between impacting inside or outside a region by forming extensive geographical networks.

As previously mentioned, universities play a critical role in providing necessary knowledge, evidence-based solutions, and innovations by researching complex socio-economic and environmental challenges [16]. Hence both university–industry partnerships and universities and technology centers are crucial for promoting sustainable growth [17–19].

This means that the universities that focus on research have no immediate short-term returns, but this is useful for local innovating companies and, moreover, HEIs become knowledge hubs that diffuse their scientific sustainability findings by means of patents and publications, which are eventually adopted by industry. Finally, universities contribute to technological development by producing and even commercializing their own technical applications by setting up spinoffs and startups and to definitively pursue SDGs [20–23].

In teaching terms, universities integrate SDGs with principles of education for sustainable development (ESD) into undergraduate and graduate courses [24,25]. HEIs also provide training to all course coordinators and curriculum developers to orient curricula toward SDGs. However according to [25], lack of appropriate guidelines for universities does not facilitate the evolution of SDG achievements in higher education. Thus, some of the most frequently found reasons for not integrating SDGs into curricula were lack of training and the difficulty of incorporating SDGs into courses. Conversely, according to [26], the most challenging sustainable development aspects, and indeed those of the SDGs, is development after information (cognitive aspects) having "sunk in" and students' perceptions (as well as affective attitudes) having further evolved through continuous learning because such continuous learning occurs outside and inside classrooms and is supported by both in-class experiences and other formative events in students' lives. Thus, [27] conducted a survey in 2019 to collect data on the ways SDGs were integrated into the learning process in 140 worldwide HEIs. Only 43% of them have made the strategic decision to include SDGs in their curricula.

Following [13], operations and governance represent the third core pillars for HEIs to boost SDG adoption. Accordingly, most campuses function as microcosms of society with housing, transport, food outlets, health services, and so on. Hence, they serve for testing and exploring SDG solutions [28,29]. Along these lines, the case study of [30] about the Brazilian University of Passo Fundo confirmed how green areas on university campuses can contribute to and interact with SDGs, especially through management actions.

Dzimińska et al. (2020) [31] proposed a model about how universities might engage in promoting sustainable development activities in the three core areas of HEIs: teaching, research, and serving society. Some remarkable academic research projects have been performed jointly by academics-scientists and students at HEIs, such as that by Carnegie Mellon University to enhance campus sustainability by analyzing university sustainability impacts beyond environmental aspects (carbon emissions) in different areas, such as campus buildings, water and waste management, transportation, education and research, social and behavioral dimensions, economic–financial aspects, and organizational structure. The project-based learning experience concluded with the recommendation of setting up centralized office sustainability to coordinate separate efforts to enhance sustainability activities in order to provide a competitive advantage in campus operations, research, and education [32]. Similar results were obtained by [33] thanks to his experience as a former college president.

Finally, the fourth core function, in accordance with Bhowmik (2018) [11], is about how universities increasingly seek to promote community engagement and to create a sense of identity for their stakeholders, which include students, faculty, administrative staff, local firms, government, and society at large [34,35].

So although an increasing number of studies have been performed to analyze the contribution of universities to the SDGs [36,37], existing research mainly describes the sustainable initiatives taken individually by HEIs, while an assessment in terms of SDG transparency and performance achieved globally by HEIs is still lacking. Sustainability

reporting in higher education is still in its early days in terms of both quantity and quality [38–40]. Even though HEIs have practiced sustainability at different levels (teaching, research, campus operations, institutional framework), they have been slow to adopt sustainability reporting practices, including publishing consistent and periodic reports, receiving third-party assurance, and integrating sustainability reporting into universities' sustainability management systems [41]. In fact, according to [42], in 2019 HEIs were behind in their process of implementing the SDGs.

The actions required to fulfill the SDGs require indicators of progress, but also the identification of specific accountabilities, which involves university management, university stakeholders, and policymakers [26,27,43,44]. This means that any progress made should be highlighted in annual reports as part of HEIs' strategic achievements and measures put in place to respond to potential failures [25,45]. Hence the main problem for HEIs fully engaging in sustainability lies in them lacking long-term policies and resources to achieve and promote the SDGs. Consequently, this allows us to understand that HEIs' leaders are guided by interests other than SDG achievements. Indeed, universities' marketing is a fact in the present day: Higher education has become commoditized by enhancing competition among HEIs to attract and retain students.

This competitive attitude of HEIs could be positive if they strive for quality education instead. In fact, the 17 SDGs represent challenges for HEIs to address these global issues, specifically SDG4, whose aim is to provide universal access to quality higher education. Thus, the complexity of determining the targets and key performance indicators that allow the fulfillment of the SDGs to be measured arises. However, HEIs are not occupied with identifying and quantifying key indicators to fulfill the SDGs, even though they use the metric management model (henceforth referred to as MMM) to evaluate their performance and to compare it to others [46]. The MMM is a system based on quantitative indicators called metrics, which summarize right behavior with a numerical score [46].

In fact, implementing the MMM by HEIs has led to the quick widespread emergence of rankings (QS World Ranking, Shanghai Ranking, The World University Ranking, Scimago Institutions Ranking). To date, the primary aim of these rankings has been to evaluate universities' academic and research reputation, or their performance, by paying minimal attention to sustainability-related issues [47].

On the one hand, these rankings position universities according to dimensions, which are rarely related to graduates' capability to improve the world or foster employability and economic growth [48], but help universities to promote themselves in an attempt to capture "clients" (students) and keep their fund providers happy, regardless of them being private or public. It is not just the position in the ranking that matters, but also the rising position in the ranking, the quartile, and the trend. Any metric matters, provided it continues to satisfy the appetite of HEIs' stakeholders: students from abroad or in the country, researchers, new player HEIs, university leaders, capital funds, politicians. Thus, rankings influence how HEIs are governed, how resources are managed, and how priorities are set [49–51]. Consequently, a university is quite likely to rise in the aforementioned rankings without making any significant societal contribution. Following Dixon's thinking (1975) [51], science is often used for other purposes than social benefit. So even when numerical indicators are intended to be "objective" and "neutral," as generated by a scientific process, the quality of quantitative data depends on the quality and reliability of collected data [52]. It is known that quantitative indicators are reductionist and only capture one part of the full social objective [2,53,54]. However, by following the thinking of Michael Faraday, what is not measured is not controlled and cannot be improved [55].

In addition, the private institutions that devise rankings indistinctively qualify public and private worldwide universities, regardless of their legal form, size, geographic location, and the origin and volume of their funding [50].

As HEIs' concern for sustainability grows, so does the publishing of the rankings that quantify HEIs' contribution to quantifying their sustainability impact (Green League 2007,

the Environmental and Social Responsibility Index 2009, UI GreenMetric World University Ranking; STARS) [56,57]. Ever since these green rankings emerged, several analyses have been carried out and reached the same conclusions: The initiative to incorporate sustainability into HEIs is good, but stability and transparency for reporting information about sustainability and the need for an integrated approach to sustainability in culture and university management are lacking [47,58–60].

Despite the emergence of "green indicators," no ranking explicitly quantified HEIs' level of fulfilling the SDGs until 2019. The *Times Higher Education* Impact Rankings (THE Impact Rankings) started assessing HEIs' performance against the SDGs [61].

This study is a novel contribution to the existing literature and bridges the gap in the literature about no assessment in terms of SDG transparency and performance achieved by HEIs being globally available. As previously mentioned, sustainability reporting in higher education is still in its early days if we consider both quantity and quality [34–36]. In addition, the literature on SDG reporting by higher education institutions is limited to single case studies and lacks empirical research. This is why the present work poses and evaluates six research hypotheses. This study models and quantifies the impact of disclosing information about SDG information by HEIs about the score obtained by universities in the THE Impact Rankings to measure how universities' efforts toward sustainability explain their overall THE score, which consequently affects their public perception (reputation). To do so, we test the hypotheses of the best ranked universities being significantly related to different SDGs than the not-so-well-ranked universities in the overall score.

Second, we model whether the SDGs relate differently depending on distinct dimensions: teaching, research, citations, industry income, and international outlook. We also model subject rankings to measure how they are aligned with SDG achievements. In addition, the possible geographical differences in the overall score and the alignment of this score with the different SDGs are studied.

Third, as only a few institutions provide information about SDGs, we test whether the overall score is a determining factor for the probability of reporting each piece of SDG information. Fourth, we check whether the percentage of female students enrolled in a university increases the probability of that university reporting information about the SDGs, as the literature evidences that the female student ratio is a driver for promoting transparency at HEIs [40]. Our work is based on data from 2019 and 2020 for the THE overall ranking and SDG scores.

This paper is arranged as follows. Section 2 describes the sources of information and data herein employed, the methodology, and the research hypothesis. Section 3 presents the results. Finally, the discussion of the results and a few final remarks are provided.

2. Methods

2.1. Sources of Information

The *Times Higher Education* (THE) has annually devised the World University Rankings since 2004 [61]. Since then, institutions have provided and signed off on their institutional data to be use in rankings on an annual basis. Thus in 2019, the criteria required by HEIs to be included in the ranking were to teach undergraduates, to publish more than 1000 research papers (indexed by Scopus) over a 5-year period (2013–2017) with a minimum of 150 per year, and to perform wide-ranging activity (no more than 80% of activity exclusively in one of the 11 subject areas).

It should be noted that, unlike other HEI rankings, the World University Rankings carried out by *Times Higher Education* is the only classification system that has been independently audited, in this case by PricewaterhouseCoopers (PwC).

In 2019, 1258 HEIs provided information to THE to devise the World University Rankings, with 1397 in 2020.

The World University Rankings are the result of compiling the data that come directly from HEIs' performance in five key performance indicator groups: teaching, research (volume, income, reputation), citations (research influence), knowledge transfer (industry income), and international outlook (staff, students, research).

THE generates the overall score for each institution as a mark composed of 13 key performance indicators (KPIs) grouped into five areas: teaching (30%), research (30%), citations (30%), industry income (7.5%), and international outlook (2.5%).

In addition to the overall score, and for first time in 2019, THE ranked HEIs' sustainability level by building and computing 11 rankings based on 11 SDGs. Thus, information for SDGs 1, 2, 6, 7, 14, and 15 was missing in 2019, which explains why THE only ranked 11 of the 17 SDGs in 2019. However, 17 rankings based on the 17 SDGs were built in 2020 and indicated a positive trend in disclosing information about SDGs.

Of the almost 20,000 HEIs worldwide, according to the International Association of Universities World Higher Education Database, 346 and 532 submitted data about their SDGs performance in 2019 and 2020, respectively. Note that the universities reporting to THE do not necessarily send information about all the SDGs. Consequently, the number of observations in certain SDG rankings lowers.

As this study aimed to analyze how disclosing information about the SDGs is related to the overall ranking of the best universities in 2019 and 2020, each SDG ranking was defined in accordance with THE below [61]:

SDG01_score: No poverty. This ranking focuses on universities' research into poverty and their support for poor students and poor members of their local community.
SDG02_score: Zero hunger. This ranking focuses on universities' research into hunger, their teaching on food sustainability, and their commitment to tackling food waste and addressing hunger in students and local communities.
SDG03_score: Good health and well-being. This ranking focuses on universities' research into the key conditions and diseases with a disproportionate impact on health outcomes worldwide, their support for healthcare professions, and the health of both students and staff.
SDG04_score: Quality education. This ranking focuses on universities' contribution to early years and lifelong learning, their pedagogy research, and their commitment to inclusive education.
SDG05_score: Gender equality. This ranking focuses on universities' research into the study of gender, their gender equality policies, and their commitment to recruiting and promoting women.
SDG06_score: Clean water and sanitation. This ranking focuses on universities' research into water, their water usage, and their commitment to ensuring good water management in the wider community.
SDG07_score: Affordable and clean energy. This ranking focuses on universities' research into energy, their energy use and policies, and their commitment to promoting energy efficiency in the wider community.
SDG08_score: Decent work and economic growth. This ranking focuses on universities' role as engines for economic growth and their responsibilities as employers. It explores institutions' economic research, their employment practices, and the share of students on work placements.
SDG09_score: Industry, innovation, and infrastructure. This ranking focuses on universities' role to foster innovation and serve industry's needs.
SDG10_score: Reduced inequalities. This ranking focuses on universities' research into social inequalities, their discrimination policies, and their commitment to recruiting staff and students from underrepresented groups.
SDG11_score: Sustainable cities and communities. This ranking goes beyond the traditional sustainability view as it deals with the stewardship of resources to seek the university's role to sustain and preserve communities' heritage.

SDG12_score: Responsible consumption and production. This ranking focuses on the efficient use of resources and minimizing waste.
SDG13_score: Climate action. This ranking explores universities' climate change research, their energy use, and their preparations to deal with climate change consequences.
SDG14_score: Life below water. This ranking explores universities' research into life below water, and their education on and support for aquatic ecosystems.
SDG15_score: Life on land. This ranking explores universities' research into life on land, and their education on and support for land ecosystems.
SDG16_score: Peace, justice, and strong institutions. This ranking focuses on how universities can support strong institutions in their countries, and promote peace and justice.
SDG17_score: Partnerships for the goals. This ranking looks at the broader ways by which universities support the SDGs by collaborating with other countries to promote best practices and publish data.

2.2. Variable Description

The variables herein considered are described below. All the variables on the ranking scores for the 2019–2020 period (THE Impact Rankings by SDG, THE overall rankings, rankings per subject, and individual SDGs) were hand collected from the THE website [61].

The dependent variable of this study was the overall score (*overall*). THE generates an overall score for each institution and discloses the resulting score per institution on its website. However, on the THE website some universities are classified with an overall score within a given range. For these universities, we obtained and computed their exact overall score from the previously mentioned different KPIs.

We also considered each HEI's score per subject (computer science, engineering and technology, health, life sciences, physical sciences, psychology, arts and humanities, education, law, social sciences, business and economics) and also for the KPI group (teaching, research, citations, industry, international outlook).

We also contemplate the SDG scores based on the 17 SDGs as both independent and dependent variables based on the built model. Therefore, we defined $SDG_{X_{jt}}$ as the score reached by university j in SDG x in year t (t = 2019, 2020), for $x = 1,2,\cdots,17$; this variable took a value of 0 for those institutions with no score in SDG x.

In addition, a dummy variable for each SDG ($dSDG_{X_{-jt}}$) was included to analyze any possible alignment between the university's overall scores and the degree of disclosing information about the SDGs; the dummy variable took a value of 1 if university j obtained a score for SDG x in year t, and 0 otherwise.

We also included the control variable $N\ of\ Students_{jt}$, number of students per university (j) and year (t = 2019, 2020), as a proxy of university size [62,63]. This variable was also hand collected from the THE website, [61]. We also incorporated the dummy variable year (*year*) to control for the unobserved events, trends, or relevant time-variant variables omitted from the models.

In order to measure the impact of the geographical location on the *overall_score*, five dichotomous control variables were created (Asia, Europe, North America, South America, Oceania), with Africa being the benchmark. In line with the extant literature, the university's location conditions its research-intensive profile and influences its overall ranking [64–66]. Accordingly, because of the cultural and economic differences manifested all over the extensive American continent, we split it into two: north and south. Each continent variable took a value of 1 if the university was located in that location, and 0 otherwise. This variable was also hand collected from the THE website, [61].

The percentage of female students was evidenced as a driver of a university's tuition fees, performance, and corporate governance [41]. Therefore, we defined the variable $Female\ percentage_{jt}$ as the percentage of female students at university j in year t.

Finally, we computed the dichotomous variable $TOP500_{jt}$ to classify universities into two groups. This variable took a value of 1 if university j's overall ranking score was in the *Top 500* in year t (t = 2019, 2020), and 0 otherwise.

The database of this study was composed of 1258 and 1397 HEIs in 2019 and 2020, respectively. As a result, a matrix was created with 2655 rows and 75 columns. For each HEI, we collected information from the THE website and obtained the following variables: the overall score, the 11 subject scores, the five KPI group scores (teaching, research, citations, industry income, international outlook), number of students, female percentage, geographical location (6 dummy variables), the 17 SDG scores quantified in the THE rankings ($SDG_{X_{jt}}$), 17 dummy variables to compute the missing data for each SDG score ($dSDG_{X-jt}$), and a dummy variable to identify whether the university was in the *Top 500* ranking every year ($TOP500_{jt}$).

2.3. Research Hypothesis

Rankings attempt to assess university performance and are a tool for universities to position themselves in the international higher education scene. Even when there is no specific regulation that determines how universities' information dissemination should be, in the last 2 years THE requested universities to report not only their academic and research actions, but also their sustainability actions. Hence transparency in universities' sustainability reports is herein understood as the quantity and variety of information that they report to THE.

Thus the more information reported by universities about their sustainability actions, the greater their transparency. Following this premise, the research hypotheses of this work are set out below:

Rh1: The *overall score* is aligned with the individual SDG scores.

Rh2: The best-ranked universities are significantly related to different SDGs compared to not-so-well-ranked universities in the *overall score*.

Rh3: *Overall scores* are aligned with different SDG scores depending on the scientific field (and subject). Thus, differences in scientific fields may impact the alignment of the SDGs and the *overall ranking*.

Rh4: The KPI scores are aligned with the individual SDG scores.

Rh5: The probability of reporting SDG information is determined by the *overall score*. Only a few HEIs provide information about their SDG actions. Hence HEIs' sustainability transparency can be motivated by their *overall* score.

Rh6: The literature shows evidence for female percentage as a promoter of transparency in HEIs. Consequently, the percentage of female students may increase the probability of universities reporting information on the SDGs.

2.4. Methodology

The research methodology follows the steps set out in Table 1 to address sixresearch hypotheses.

Table 1. Research methodology.

Hypothesis	Method	Dependent Variable	Independent Variables
Rh1	Nonparametric tests (Wilcoxon-Mann-Whitney) Ordinary least squares (OLS)	*overall*	SDG scores, number of students, 17 dummy SDGs, geographical variables, year
Rh2	OLS (7 models)	*computer science, engineering and technology, health, life sciences, physical sciences, psychology, arts and Humanities, education, law, social sciences, business and economics*	SDG scores, number of students, 17 dummy SDGs, geographical variables, year
Rh3	OLS (4 models)	*overall (Q1, Q2, Q3, Q4)*	SDG scores, number of students, 17 dummy SDGs, geographical variables, year
Rh4	OLS (5 models)	*teaching, research, citations, industry income, and international outlook*	SDG scores, number of students, 17 dummy SDGs, geographical variables, year
Rh5 and Rh6	Logit (17 models)	$dSDG_{X-jt}$	overall, number of students, Top 500, female percentage, geographical variables, year

The research methodology followed to verify the posed hypotheses was first a descriptive analysis of the scores obtained by each HEI in the 28 rankings in 2019 and 2020 devised by THE, which quantify and position HEIs (the *overall score*, five indicators composing the *overall score*, 11 scores for academic disciplines, 17 scores for each SGD). Nonparametric tests (Wilcoxon–Mann–Whitney) were obtained for the mean rank differences in the *overall score*. These tests allowed us to consider whether those universities reporting information about an SDG ($dSDG_{X-jt} = 1$) had significant differences in their overall score compared to those universities not reporting information to THE ($dSDG_{X-jt} = 0$); Pearson's correlation coefficients were also calculated.

Next the methodology employed to verify the first five research hypotheses was multivariate linear regression by ordinary least squares (OLS) [67,68].

In order to analyze research hypothesis 1, two regression models were built; the dependent variable was the overall HEI score, the independent variables were the 17 SDG scores, and the control variable was the number of students, which indicated the number of students per university as a proxy of university size. In addition, the 17 dummy SDG variables, geographical variables, and the year were also included as independent variables.

Research hypothesis 2 was validated by 11 regression models. The dependent variable was all the 11 subject rankings that composed the THE *overall ranking*. In this way the relation of each subject score to the SDG scores was measured to assess whether the natural differences in scientific fields impacted the alignment of SDGs and the *overall ranking*.

Four regression models were obtained with research hypothesis 3. Here the sample was divided into quartiles, where quartile 1 comprised 25% of the best-ranked universities in the overall ranking. The equation of the model is:

$$Overall_{jt} = \beta_0 + \sum_{x=1}^{17}(\beta_x SDG_{X_{jt}}) + \beta_{18}dSDG_{1-jt} + \beta_{19}dSDG_{2-jt} + \beta_{20}dSDG_{3-jt} + \beta_{21}dSDG_{4-jt} + \beta_{22}dSDG_{5-jt} + \beta_{23}dSDG_{6-jt} + \beta_{24}dSDG_{7-jt} + \beta_{25}dSDG_{8-jt} + \beta_{26}dSDG_{9-jt} + \beta_{27}dSDG_{10-jt} + \beta_{28}dSDG_{11-jt} + \beta_{29}dSDG_{12-jt} + \beta_{30}dSDG_{13-jt} + \beta_{31}dSDG_{14-jt} + \beta_{32}dSDG_{15-jt} + \beta_{33}dSDG_{16-jt} + \beta_{34}dSDG_{17-jt} + \beta_{35}N\ of\ Students_{jt} + \beta_{36}Asia_j + \beta_{37}Europe_j + \beta_{38}NorthAmerica_j + \beta_{39}SouthAmerica_j + \beta_{40}Oceania_j + \beta_{41}year + \varepsilon \quad (1)$$

where:

Overall jt: the score of HEI *j* (*j* = from 1 to 1397) in the THE overall ranking in year *t* (*t* = 2019, 2020)

β_0: constant term

β_n: coefficients of the independent variables from n=1 to 41.

ε: random disturbance term

Research hypothesis 4 was verified by five regression models. The dependent variable was each of the five different dimensions that measure HEI performance (teaching, research, citations, industry income, international outlook). The considered independent variables were the 17 SDG scores, the 17 SDG dummy variables, the number of students, the five geographical variables, and the year. The mathematical expression is:

$$D\_score_{ijt} = \beta_0 + \sum_{x=1}^{17}\beta_x(dSDG_{x-jt} \times SDG_{X_{jt}}) + \beta_{18}dSDG_{1-jt} + \beta_{19}dSDG_{2-jt} + \beta_{20}dSDG_{3-jt} + \beta_{21}dSDG_{4-jt} + \beta_{22}dSDG_{5-jt} + \beta_{23}dSDG_{6-jt} + \beta_{24}dSDG_{7-jt} + \beta_{25}dSDG_{8-jt} + \beta_{26}dSDG_{9-jt} + \beta_{27}dSDG_{10-jt} + \beta_{28}dSDG_{11-jt} + \beta_{29}dSDG_{12-jt} + \beta_{30}dSDG_{13-jt} + \beta_{31}dSDG_{14-jt} + \beta_{32}dSDG_{15-jt} + \beta_{33}dSDG_{16-jt} + \beta_{34}dSDG_{17-jt} + \beta_{35}NofStudents_{jt} + \beta_{36}Asia_j + \beta_{37}Europe_j + \beta_{38}NorthAmerica_j + \beta_{39}SouthAmerica_j + \beta_{40}Oceania_j + \beta_{41}year + \varepsilon \quad (2)$$

where:

D_score_{ij}: the score of HEI *j* (*j* = from 1 to 1258) in the THE dimension *i* ranking (*i* = from 1 to 5) in year *t* (*t* = 2019, 2020).

β_0: constant term

β_n: coefficients of the explanatory variables, from n = 1 to 41.

ε: random disturbance term

Finally, research hypotheses 5 and 6 were validated by 17 logit models. The explanatory variable was the probability of reporting data to THE by each SDG. Thus, the probability of each dummy variable $dSDG_{X-jt} = 1$. The independent variables were the overall score, the number of students, geographical variables, the overall score Top 500, the year, and female percentage.

As only a few universities provided THE with SDG data, it seemed interesting to analyze whether this transparency was motivated or aligned with the overall ranking. As the percentage of female students evidenced a significant effect on important academic and managerial variables at universities [40], we included the female percentage to assess its impact on the institutions' SDG transparency. The model is expressed as follows:

$$Ln\left(\frac{P}{1-P}\right) = \beta_0 + \beta_1 overall_{jt} + \beta_2 NofStudents_{jt} + \beta_3 Asia_j + \beta_4 Europe_j + \beta_5 NorthAmerica_j + \beta_6 SouthAmerica_j + \beta_7 Africa_j + \beta_8 Female_{percentage_{jt}} + \beta_9 TOP500_{jt} + \beta_{10} year + \varepsilon \quad (3)$$

where:

P: the probability of HEIs providing THE with SDG data $dSDG_{X-jt} = 1$; (*x* = 1,2,…17), (*j* = from 1 to 1258) in year *t* (*t* = 2019, 2020)

β_0: constant term

β_n: coefficients of the explanatory variables from n = 1 to 10.

ε: random disturbance term

The models' goodness of fit was measured by adjusted R^2, Snedecor-F, and Student's t. The error considered that the levels were 1%, 5%, and 10%. Multicollinearity was measured by the condition index (CI) and the variance inflation factor (VIF). The latter did not exceed 10, as suggested by Gujarati [69]. So models were verified for no multicollinearity, heteroskedasticity, or specification. All the analyses were performed with the Stata 12 software.

3. Results

3.1. Descriptive Analysis

The database of our study was analyzed. Table 2 shows the results obtained for the variables contained in the study to quantify the number of observations available for each one, and the mean, standard deviation, minimum, and maximum.

Table 2. Descriptive statistics.

Variable	Number of Observations	Mean	Standard Deviation	Minimum	Maximum
Overall_score	2655	34.96	17.22	9.83	96.02
No. of Students	2655	24,175.13	39,628.98	539.00	1,413,003.00
SDG1	264	48.92	17.91	18.00	88.50
SDG2	223	49.68	21.69	18.65	94.90
SDG3	770	58.03	18.88	11.45	90.80
SDG4	779	48.16	17.77	12.90	95.00
SDG5	615	47.15	18.00	13.80	83.20
SDG6	244	45.06	14.95	11.10	81.40
SDG7	276	51.26	17.97	15.40	83.20
SDG8	548	50.48	17.50	18.95	84.40
SDG9	643	51.28	23.80	8.15	100.00
SDG10	526	46.36	17.26	16.00	91.80
SDG11	583	55.90	18.85	21.05	94.80
SDG12	450	51.08	20.96	11.60	92.30
SDG13	484	44.92	19.72	11.40	96.90
SDG14	188	51.62	22.45	11.85	97.70
SDG15	205	50.68	22.58	15.65	95.70
SDG16	532	58.25	17.57	22.50	91.20
SDG17	909	53.63	24.01	18.60	99.20
Teaching	2,655	28.43	14.50	9.20	94.50
Research	2,655	24.11	17.62	6.60	99.60
Citations	2,655	48.31	28.12	1.40	100.00
Industry Income	2,655	46.46	16.33	34.00	100.00
International Outlook	2,655	47.18	23.32	12.70	99.80
Health	1,498	36.48	14.49	18.30	91.40
Life Sciences	1,572	37.18	18.76	13.85	96.20
Physical Sciences	2,018	35.33	17.89	12.70	96.00
Psychology	959	39.90	14.57	21.00	87.50
Business & Economics	1,218	36.40	16.26	16.30	93.00
Education	905	38.54	16.46	15.60	93.00
Law_score	379	43.30	16.81	21.60	82.30
Social Sciences	912	39.48	17.99	15.30	93.90
Engineering & Technology	1,912	33.30	16.96	12.15	95.60
ComputerScience	1,568	34.84	16.80	12.15	92.20
Arts & Humanities	1,175	31.33	16.27	15.65	91.10

It is noteworthy that most universities did not provide information about all the requested variables. As regards SDGs, the number of observations lowered for the SDG scores as only a relatively few HEIs provided data about their SDG actions. This meant

for the SDG17_score on partnerships, the largest number of HEIs reported it (34% of the total number of HEIs included in *overall*). In contrast, the SDG14_score on life underwater only represented 7%. So although each SDG is different, they are evaluated based on three main metric groups: research, impact, and evidence.

Research metrics were derived from the data supplied by Elsevier. For each SDG, a specific query was created, which narrowed the scope of the metric to the relevant papers for SDGs by employing a five-year period between 2013 and 2017. Continuous metrics measured any contributions to impacts that continually varied across a range, e.g., the number of graduates with a health-related degree, which are usually normalized to the institution's size. Evidence is normally evaluated against a set of criteria, and decisions are cross-validated when uncertainty appears. Evidence does not need to be exhaustive, but demonstrate the best practices carried out at the studied institutions.

In order to prepare subject rankings, two criteria were included: a publication threshold per discipline and an academic staff threshold per discipline. The publication thresholds differed for the 11 subject rankings. For example, in computer science the threshold dropped to 500 papers published in the past five years, and to 250 in arts and humanities. There was also an academic staff eligibility criterion. An institution needed to have at least a proportion or a specific number of its staff in this discipline in the subject ranking. Therefore, the number of observations made about these rankings varied between law, which was the discipline with the fewest universities in the general ranking (14%), and physical sciences, with the highest percentage of universities (76%).

Finally, it was important to analyze the weight of each geographical area. As seen in Figure 1, European universities represented 39% of the total sample, followed by Asian universities (32%). Next, the HEIs from the American continent were split into north (16%) and south (6%). African universities represented 4% and the HEIs located in Oceania represented 3% of the total.

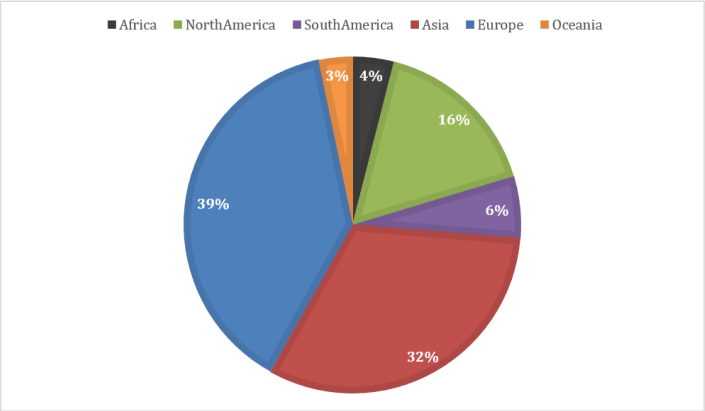


Figure 1. The sample's geographic composition.

Figure 1 shows the descriptive statistics per geographical location. When dividing the sample by regions, some continents became statistically invaluable because of the few observations. At the same time, it should be noted that the HEIs located in North America and Oceania were those with the highest average *overall_score* (Table 3). Conversely, South American universities obtained the lowest average values and, therefore, the study evidenced geographical differences in the HEIs' *overall scores*, (Table 3).

Table 3. Descriptive statistics per region.

	Africa			North America			South America		
Variable	**Obs**	**Mean**	**Std. Dev.**	**Obs**	**Mean**	**Std. Dev.**	**Obs**	**Mean**	**Std. Dev.**
Overall	105	24.67	10.07	436	46.87	19.65	157	21.53	8.32
SDG1	18	40.49	16.84	23	62.54	17.02	29	53.21	15.08

SDG2	15	40.78	18.68	25	60.43	20.99	23	50.92	21.76
SDG3	53	46.99	15.18	93	66.34	15.54	61	54.49	15.99
SDG4	52	41.30	17.58	87	53.78	14.59	66	51.25	18.09
SDG5	41	38.53	15.62	70	58.14	11.22	45	45.87	16.33
SDG6	16	36.65	11.94	30	53.82	12.73	17	42.63	13.93
SDG7	15	38.22	16.84	30	57.31	15.26	21	46.18	20.51
SDG8	32	32.21	15.43	55	51.44	15.56	38	51.08	18.01
SDG9	34	30.84	17.64	74	62.34	23.80	41	37.07	19.77
SDG10	28	37.58	17.29	62	52.79	14.99	45	42.47	13.44
SDG11	30	36.16	14.60	80	68.14	16.15	42	43.92	15.81
SDG12	19	30.68	15.75	57	58.73	18.20	32	42.42	16.97
SDG13	26	33.53	14.58	62	56.27	21.29	31	40.72	18.38
SDG14	7	42.34	18.74	21	71.01	22.70	14	44.87	20.52
SDG15	7	32.30	23.64	20	69.58	18.11	17	42.73	22.80
SDG16	33	49.70	15.54	58	66.04	14.40	44	49.10	17.27
SDG17	56	42.30	23.31	107	58.81	22.96	67	47.95	22.76
No of FTE Students	105	68,104.04	62,231.14	436	26,843.54	23,192.17	157	26,832.92	16,913.32
		Asia			**Europe**			**Oceania**	
Variable	**Obs**	**Mean**	**Std. Dev.**	**Obs**	**Mean**	**Std. Dev.**	**Obs**	**Mean**	**Std. Dev.**
Overall	845	27.58	13.17	1026	38.01	16.23	86	47.74	11.32
SDG1	97	44.17	17.03	90	49.37	17.61	7	68.17	9.14
SDG2	80	48.76	22.68	71	45.49	19.22	9	72.56	15.34
SDG3	234	54.58	18.45	285	58.13	19.53	44	76.34	11.45
SDG4	242	42.04	17.81	293	49.31	16.35	39	68.86	10.13
SDG5	192	34.95	15.67	229	51.94	15.39	38	70.49	6.82
SDG6	94	42.69	15.02	76	45.11	14.04	11	56.98	17.25
SDG7	92	45.25	17.82	104	54.71	15.35	14	73.66	7.33
SDG8	179	46.81	16.00	212	53.67	17.11	32	65.70	12.70
SDG9	227	50.45	24.88	246	53.84	21.30	21	52.06	24.54
SDG10	163	39.66	15.81	191	48.58	16.79	37	65.06	12.79
SDG11	185	49.81	16.43	215	58.37	16.97	31	78.86	11.98
SDG12	147	46.24	16.81	176	54.50	23.25	19	68.91	15.33
SDG13	153	37.38	18.85	192	48.37	17.94	20	55.66	14.50
SDG14	70	43.56	19.13	68	52.92	21.09	8	80.09	12.08
SDG15	79	44.65	19.55	71	51.73	21.62	11	76.88	15.84
SDG16	160	51.32	16.81	209	6267	16.45	28	73.29	10.10
SDG17	289	48.41	22.58	341	56,51	23.85	49	73.78	20.66
No of FTE Students	845	18,596.68	22,326.88	1026	22,928.31	52,440.06	86	21,847.09	11,880.94

We assessed the direct linear relation between pairs of variables using Pearson's correlation coefficient (Table 4; * represent a significant level of 10%). The correlation matrix results evidenced a positive correlation for the *overall score* with all the *SDG_scores*. This confirmed the relevance of the variables herein considered, but it was necessary to better understand the dynamics of the *SDG_scores* when controlled by other factors.

Table 4. Pearson's correlation matrix.

	Overall	No. of FTE Students	SDG1	SDG2	SDG3	SDG4	SDG5	SDG6	SDG7	SDG8	SDG9	SDG10	SDG11	SDG12	SDG13	SDG14	SDG15	SDG16	SDG17
Overall	1.000																		
No. of FTE Students	−0.0340	1.000																	
SDG1	0.3704 *	0.0151	1.000																
SDG2	0.2932 *	−0.0708	0.5636 *	1.000															
SDG3	0.4928 *	0.0590	0.4417 *	0.3854 *	1.000														
SDG4	0.4230 *	−0.0565	0.5109 *	0.3697 *	0.4702 *	1000													
SDG5	0.4972 *	0.0694	0.5291 *	0.3217 *	0.5343 *	0.6524 *	1.000												
SDG6	0.3438 *	0.0696	0.6002 *	0.5739 *	0.3763 *	0.5263 *	0.4921 *	1.000											
SDG7	0.4428 *	0.0674	0.5363 *	0.5118 *	0.4199 *	0.5139 *	0.5406 *	0.6182 *	1.000										
SDG8	0.3803 *	−0.0767	0.4908 *	0.3727 *	0.3583 *	0.4311 *	0.4442 *	0.4646 *	0.5610 *	1.000									
SDG9	0.5902 *	0.0178	0.4713 *	0.3940 *	0.4009 *	0.3525 *	0.2673 *	0.3912 *	0.4581 *	0.4187 *	1.000								
SDG10	0.4898 *	−0.0548	0.5373 *	0.3296 *	0.4600 *	0.6690 *	0.6134 *	0.4949 *	0.5397 *	0.5157 *	0.4279 *	1.000							
SDG11	0.5880 *	−0.0139	0.5564 *	0.4955 *	0.5217 *	0.4839 *	0.5425 *	0.5733 *	0.6675 *	0.5722 *	0.6255 *	0.5745 *	1.000						
SDG12	0.5129 *	−0.0089	0.5020 *	0.5327 *	0.4603 *	0.4303 *	0.4489 *	0.6027 *	0.5753 *	0.4804 *	0.4597 *	0.4537 *	0.6478 *	1.000					
SDG13	0.4772 *	0.0100	0.4215 *	0.4516 *	0.3998 *	0.3635 *	0.4754 *	0.4567 *	0.5273 *	0.3656 *	0.3430 *	0.3176 *	0.5134 *	0.4762 *	1.000				
SDG14	0.4369 *	0.2306 *	0.6836 *	0.6211 *	0.4820 *	0.5087 *	0.5714 *	0.6086 *	0.6373 *	0.4375 *	0.4389 *	0.5148 *	0.7338 *	0.6186 *	0.5204 *	1.000			
SDG15	0.4784 *	0.2565 *	0.6397 *	0.6055 *	0.5445 *	0.5322 *	0.5866 *	0.6340 *	0.6421 *	0.5234 *	0.4756 *	0.6059 *	0.7850 *	0.6756 *	0.5126 *	0.7859 *	1.000		

SDG16	0.4818 *	0.0104	0.4921 *	0.3975 *	0.5655 *	0.4683 *	0.5470 *	0.4465 *	0.5417 *	0.4856 *	0.3926 *	0.5288 *	0.6182 *	0.4859 *	0.4253 *	0.5624 *	0.6413 *	1.000	
SDG17	0.4785 *	−0.0291	0.5995 *	0.5106 *	0.4983 *	0.5099 *	0.5088 *	0.5601 *	0.5558 *	0.4550 *	0.4371 *	0.4876 *	0.6068 *	0.5829 *	0.4120 *	0.5853 *	0.6495 *	0.5736 *	1.000
Female_%	0.0817 *	0.0588 *	0.1207	0.0265	0.3224 *	0.3150 *	0.4363 *	0.0934	0.0806	0.1192 *	−0.0862 *	0.2548 *	0.1137 *	0.0612	0.0469	0.1715 *	0.1483 *	0.3345 *	0.1655 *

In line with the exploratory analyses, the nonparametric Wilcoxon–Mann–Whitney test results (Table 5) showed rank differences in the *overall score* for those institutions reporting SDGs, except for the SDGs on clean energy, responsible consumption, climate, and life underwater (SDG7, 12, 13, and 14, respectively).

Table 5. Nonparametric Wilcoxon–Mann–Whitney test.

	Observation 0	Observation 1	Z	Probability > Z
dSDG1	2391	264	4.3380	0.0000 ***
dSDG2	2432	223	3.0430	0.0023 ***
dSDG3	1885	770	3.1600	0.0016 ***
dSDG4	1876	779	6.8030	0.0000 ***
dSDG5	2040	615	3.3830	0.0007 ***
dSDG6	2411	244	1.8890	0.0588 *
dSDG7	2379	276	1.2000	0.2303
dSDG8	2107	548	2.7010	0.0069 ***
dSDG9	2012	643	3.3090	0.0009 ***
dSDG10	2129	526	3.4150	0.0006 ***
dSDG11	2072	583	2.0240	0.0430 **
dSDG12	2205	450	1.5830	0.1134
dSDG13	2171	484	1.3580	0.1745
dSDG14	2467	188	0.9380	0.3483
dSDG15	2450	205	1.8160	0.0693 *
dSDG16	2123	532	2.8840	0.0039 ***
dSDG17	1746	909	5.7100	0.0000 ***

*, **, and *** represent a significant level at 10%, 5%, and 1%, respectively.

3.2. Linear Regression Analysis

The main aim of this paper was to assess the alignment of the SDGs with the overall score in the THE ranking. Thus, our study intended to quantify the degree of alignment between the SDG information reported by HEIs and their overall score, but also the alignment between the overall score and SDG scores. This allowed the different sustainability dimensions and tasks performed by HEIs that impacted their overall score to be modeled.

In line with this hypothesis, five linear regression models were computed by considering both SDG scores and some control variables with one model for the whole sample (n = 2655) and four additional models for each quartile in the sample. The models (Table 6) were globally significant at 1% (p-value < 0.01) with no multicollinearity problems, and the VIF coefficients were always below 10. The total model explained 31% of the variability of the *overall score*.

Table 6. Linear regression model of the overall score.

	Total		Quartile 1		Quartile 2		Quartile 3		Quartile 4	
Variable	**Robust Coeffi-cient**	**t**	**Robust Coeffi-cient**	**t**	**Robust Coeffi-cient**	**t**	**Robust Coeffi-cient**	**t**	**Robust Coeffi-cient**	**t**
SDG1	−0.07	−1.43	−0.09	−0.77	−0.06	−1.65 *	0.01	0.38	0.03	1.65 *
SDG2	−0.04	−0.84	−0.01	−0.12	0.00	0.15	0.00	−0.21	−0.01	−0.34
SDG3	0.14	5.28 ***	0.06	1.04	0.05	2.36 **	0.00	−0.32	−0.02	−1.92 *
SDG4	0.06	1.95 *	−0.14	−1.87 *	−0.01	−0.25	0.01	0.93	−0.01	−0.76
SDG5	−0.02	−0.59	0.04	0.46	−0.08	−2.83 ***	0.00	−0.23	0.02	1.05
SDG6	−0.06	−0.9	0.11	0.69	−0.04	−1.20	−0.02	−0.69	0.00	0.12
SDG7	0.00	−0.03	0.16	1.85 *	−0.02	−0.53	−0.01	−0.41	0.00	0.09
SDG8	0.00	−0.09	−0.12	−2.12 **	−0.02	−1.17	−0.06	−3.30 ***	0.00	0.02
SDG9	0.25	9.59 ***	0.19	4.43 ***	0.01	0.56	0.03	1.82 *	0.04	3.40 ***
SDG10	0.05	1.11	0.03	0.31	0.03	1.25	0.04	2.13 **	0.03	1.39
SDG11	0.01	0.20	−0.09	−1.03	0.05	1.88 *	−0.02	−0.83	0.01	0.74
SDG12	0.07	2.19 **	0.01	0.19	0.02	0.95	0.07	4.52 ***	0.01	0.74
SDG13	0.08	2.20 **	−0.02	−0.33	0.01	0.53	−0.01	−0.33	0.02	1.13
SDG14	−0.03	−0.59	−0.05	−0.52	0.05	1.12	0.00	0.01	0.00	−0.13
SDG15	0.01	0.25	0.03	0.45	−0.05	−1.08	−0.03	−0.86	−0.05	−1.99 **
SDG16	−0.02	−0.50	0.22	3.49 ***	0.07	3.06 ***	0.01	0.29	0.01	0.51
SDG17	0.08	3.71 ***	0.07	1.41	−0.01	−1.03	0.02	2.03 **	0.02	2.15 **
dSDG1	2.19	0.89	4.91	0.59	1.94	0.88	−0.19	−0.13	−3.18	−3.38 ***
dSDG2	−0.51	−0.17	−2.36	−0.34	−0.56	−0.31	0.75	0.45	0.56	0.53
dSDG3	−5.41	−3.36 ***	−3.20	−0.64	−1.92	−1.40	−0.10	−0.10	1.66	2.41 **
dSDG4	−5.59	−3.17 ***	7.98	1.52	0.31	0.25	−0.71	−0.74	0.89	1.18
dSDG5	2.51	1.38	−1.63	−0.29	5.10	3.04 ***	−0.03	−0.03	−0.93	−1.35
dSDG6	1.88	0.56	−3.33	−0.45	2.28	1.25	1.30	0.67	0.31	0.28
dSDG7	1.48	0.44	−12.26	−1.96 **	0.82	0.39	−0.06	−0.04	−0.38	−0.36
dSDG8	2.03	1.10	6.40	1.53	1.66	1.29	2.98	2.83 ***	0.26	0.31
dSDG9	−10.54	−7.00 ***	−12.61	−4.08 ***	1.55	1.56	−2.00	−2.23 **	−1.45	−2.44 **
dSDG10	−3.07	−1.52	−3.79	−0.70	−1.90	−1.15	−1.03	−0.95	−1.01	−1.22
dSDG11	0.44	0.19	8.18	1.25	−3.32	−2.04 **	1.18	0.85	−0.47	−0.59
dSDG12	−4.31	−2.50 ***	1.61	0.47	−0.07	−0.07	−3.49	−3.86 ***	−1.46	−1.80 *
dSDG13	−2.76	−1.47	1.34	0.34	−1.03	−0.76	0.17	0.16	−0.27	−0.39
dSDG14	2.16	0.56	3.02	0.37	−1.87	−0.54	−1.21	−0.69	1.58	1.32
dSDG15	−0.27	−0.08	0.55	0.11	2.07	0.59	0.70	0.39	1.70	1.60
dSDG16	1.74	0.75	−16.93	−3.48 ***	−4.58	−2.72 ***	0.06	0.04	−0.50	−0.52
dSDG17	−10.37	−7.19 ***	−8.39	−2.16 **	−1.59	−1.85 *	−1.12	−1.54	−1.67	−2.71 ***
No. of Students	0.00	−1.99 **	0.00	3.01 ***	0.00	−1.16	0.00	0.05	0.00	3.53 ***
Year	−0.54	−0.83	−0.61	−0.59	0.11	0.34	−0.19	−0.68	0.38	1.68 *
North America	16.50	10.96 ***	9.25	4.40 ***	0.90	0.80	2.14	2.75 ***	−2.64	−4.25 ***
South America	−5.47	−3.95 ***	−11.08	−3.31 ***	−0.05	−0.04	0.02	0.02	−0.46	−0.98
Asia	−1.13	−0.91	6.43	2.81 ***	−0.57	−0.51	−0.06	−0.08	−0.30	−0.73
Europe	8.41	6.67 ***	4.38	2.31 **	0.78	0.72	0.95	1.32	−0.60	−1.43
Oceania	16.16	9.27 ***	4.12	1.69 *	1.52	1.20	3.11	3.55 ***	omitted	
Cons	1113.54	0.85	1288.52	0.62	−184.02	−0.28	400.07	0.73	−750.61	−1.64
N	2655		664		663		664		664	
F	39.94 (0.0000) ***		4.92 (0.0000) ***		3.50 (0.0000) ***		4.38 (0.0000) ***		4.21 (0,0000) ***	
R-squared	0.3075		0.1237		0.1096		0.1330		0.1364	

*, **, and *** represent a significant level of 10%, 5%, and 1%, respectively.

For the control variables, when considering the total sample, the number of students was significantly related to the *overall score*, as were all the continents, except Asia (Table 6, Total model). In particular, the HEIs located in North America, Oceania, and Europe obtained higher overall scores in the general ranking.

Regarding the SDGs, we focused on the effect of reporting SDG information and the particular *SDG_score*. Reporting information about SDG3, SDG4, SDG9, SDG12, and SDG 17 negatively impacted the score obtained in the general ranking. However, the HEIs that reported information about SDG3, SDG4, SDG9, SDG12, SDG13, and SDG17 obtained higher scores in these SDG rankings, which positively affected their overall score. In other words, the more positive the actions related to health, education, industry, responsible consumption and production, climate action, and partnerships were, the higher the university's position in the general ranking was when universities reported it through the SDGs.

However, no other SDG showed a significant relation with the overall score. Fulfilling the SDGs by 2030 requires universities to be committed to the 17 goals, which would be favored by a closer relation between the actions reported toward each SDG and the HEIs' overall ranking value.

As Table 6 shows, four SDGs aligned with quartile 1, SDG4, and SDG8 were negatively aligned, whereas SDG9 and SDG16 were positively aligned. In particular, the best-ranked universities reporting information about the SDGs were the best-ranked in the overall score insofar as they committed less to their role as employers and economic promoters (SDG 8, economic growth), and focused the least on pedagogy research and inclusive education (SDG 4, education). In contrast, the best-ranked universities were more committed to transferring knowledge to industry to cover their needs (SDG 9), to support strong institutions in their countries, and to promote peace and justice (SDG 16). This would indicate that the overall ranking favors "elite universities" occupying the top positions, which are those that are socially committed to promoting justice in their countries, but are not committed to inclusive education and to studying education as a science. Quartile 1 evidenced a significant relation with geographical location and number of students, whereas quartile 2 did not. The effect of SDG 5 on quartile 2 was interesting, and reporting information about gender actions increased the *overall ranking* score of those universities especially committed to gender equality, but not "extremely rewarded" by the overall score. With quartile 4, we found that HEIs' commitment to poverty, industry, and partnerships (SDG1, SDG9, and SDG17) favored their position in the *overall ranking*.

Regarding the *overall score* dimensions, the five models (Table 7) were globally significant at 1% and avoided multicollinearity and heteroskedasticity problems. The SDGs' explanatory power oscillated within this interval: [2%, 39%]. In particular, the SDGs contributed to explaining a higher proportion of the international outlook score ($R^2 = 0.388$), followed by the citations score (32% of variability explained by the model).

Table 7. Linear regression models of the overall score per dimension (KPIs).

	Teaching		Research		Citations		Industry Income		International Outlook	
Variable	**Robust Coeffi-cient**	**t**	**Robust Coeffi-cient**	**t**	**Robust Coeffi-cient**	**t**	**Robust Coeffi-cient**	**t**	**Robust Coeffi-cient**	**t**
SDG1	0.04	0.86	−0.04	−0.85	−0.20	−2.25 **	0.03	0.45	−0.10	−1.29
SDG2	0.02	0.62	0.01	0.21	−0.14	−1.44	0.03	0.76	−0.13	−1.94 *
SDG3	0.02	0.96	0.07	2.66 ***	0.32	6.25 ***	0.02	0.54	0.15	3.72 ***
SDG4	−0.01	−0.40	0.02	0.80	0.16	2.79 ***	0.04	1.22	0.05	1.04
SDG5	−0.01	−0.27	−0.05	−1.48	0.03	0.47	−0.02	−0.36	−0.16	−2.86 ***
SDG6	−0.06	−1.03	−0.05	−0.81	−0.07	−0.58	0.22	2.70 ***	−0.14	−1.63
SDG7	−0.04	−0.75	0.02	0.44	−0.03	−0.30	0.05	0.78	0.13	1.96 *
SDG8	0.00	−0.15	0.04	1.16	−0.05	−0.82	0.08	2.06 **	0.02	0.41
SDG9	0.26	9.71 ***	0.34	11.97 ***	0.17	3.61 ***	0.34	11.07 ***	0.15	4.21 ***
SDG10	0.03	0.81	0.01	0.24	0.07	0.89	−0.06	−1.18	0.20	3.29 ***
SDG11	−0.05	−1.55	−0.02	−0.57	0.09	1.19	−0.05	−1.12	0.05	0.92
SDG12	0.01	0.42	0.02	0.62	0.16	2.77 ***	−0.05	−1.47	0.13	2.73 ***
SDG13	0.06	1.98 **	0.06	1.70 *	0.11	1.75 *	−0.02	−0.53	0.08	1.65 *
SDG14	−0.05	−0.99	−0.01	−0.13	−0.06	−0.54	−0.10	−1.53	0.03	0.26
SDG15	0.00	−0.01	0.03	0.56	0.03	0.29	−0.06	−1.24	−0.04	−0.41
SDG16	0.03	0.93	0.03	0.95	−0.14	−1.81 *	−0.01	−0.30	0.07	1.29
SDG17	0.08	3.84 ***	0.07	2.92 ***	0.10	2.31 **	−0.03	−1.07	0.15	4.57 ***
dSDG1	−2.38	−1.13	1.05	0.44	8.64	1.68 *	−3.40	−0.99	1.14	0.26
dSDG2	−3.70	−1.60	−3.73	−1.43	4.10	0.62	−2.36	−0.75	7.33	1.54
dSDG3	1.00	0.67	−2.36	−1.55	−15.09	−4.46 ***	0.03	0.01	−6.39	−2.42 **
dSDG4	−1.11	−0.74	−3.19	−2.01 **	−12.22	−3.43 ***	−7.03	−3.33 ***	−6.15	−2.11 **
dSDG5	0.62	0.42	3.02	1.81 *	2.13	0.58	1.01	0.40	10.10	3.29 ***
dSDG6	2.36	0.91	2.21	0.74	0.69	0.10	−9.40	−2.47 **	7.16	1.66 *
dSDG7	3.12	1.17	1.12	0.37	2.12	0.31	−0.35	−0.10	−5.60	−1.36
dSDG8	0.96	0.60	−0.21	−0.12	6.03	1.51	−2.31	−1.03	0.68	0.21
dSDG9	−10.70	−8.10 ***	−14.51	−10.11 ***	−6.66	−2.13 **	−12.66	−7.93 ***	−8.85	−3.97 ***
dSDG10	−2.53	−1.51	−0.13	−0.07	−5.38	−1.34	5.27	2.05 **	−10.55	−3.34 ***
dSDG11	3.64	1.86 *	2.04	0.94	−4.18	−0.85	3.13	1.30	−1.17	−0.35
dSDG12	−2.87	−2.09 **	−2.00	−1.27	−7.77	−2.05 **	1.38	0.71	−7.35	−2.60 ***
dSDG13	−1.13	−0.72	−1.52	−0.86	−6.08	−1.59	0.47	0.21	−2.00	−0.76
dSDG14	2.62	0.91	−0.14	−0.04	4.95	0.66	3.79	0.80	−2.25	−0.32
dSDG15	0.11	0.04	−0.93	−0.29	−0.60	−0.09	2.44	0.61	1.23	0.19
dSDG16	−1.46	−0.80	−1.18	−0.58	9.29	1.81 *	−2.48	−0.99	−2.59	−0.74
dSDG17	−8.68	−6.96 ***	−9.99	−7.38 ***	−13.75	−4.84 ***	1.06	0.58	−8.88	−4.12 ***
N of Students	0.00	−0.91	0.00	2.21 **	0.00	−2.63 ***	0.00	3.44 ***	0.00	−3.58 ***
Year	−0.61	−1.02	−0.79	−1.11	−0.02	−0.02	−0.65	−0.96	−1.26	−1.57
NorthAmerica	15.28	13.34 ***	16.91	11.31 ***	22.51	7.72 ***	3.75	2.37 **	−0.10	−0.06
SouthAmerica	−0.28	−0.31	−1.18	−1.00	−13.55	−4.28 ***	−0.68	−0.43	−12.64	−7.44 ***
Asia	4.39	5.45 ***	4.20	3.74 ***	−9.12	−3.34 ***	9.13	5.80 ***	−16.05	−10.32 ***
Europe	5.87	7.39 ***	9.11	8.07 ***	10.53	3.85 ***	5.73	3.70 ***	8.16	5.35 ***
Oceania	6.01	4.11 ***	16.39	8.65 ***	23.07	7.17 ***	8.63	4.29 ***	30.68	15.91 ***
Cons	1245.16	1.04	1618.26	1.13	86.13	0.04	1359.88	0.98	2595.69	1.60
N	2655		2655		2655		2655		2655	
F	18.69 (0.0000) ***		26.27 (0.0000) ***		41.53 (0.0000) ***		12.05 (0.0000) ***		68.43 (0.0000) ***	
R-squared	0.1938		0.2184		0.3188		0.1184		0.3878	

*, **, and *** represent a significance level of 10%, 5%, and 1%, respectively.

As an overview, when analyzing Figure 2, we found that SDG9 was significant in all the models, and SDG17 was significant in four of the five considered models. We can also state that the SDG score seemed to have a stronger influence (black bars) than reporting information about SDGs (gray bars).

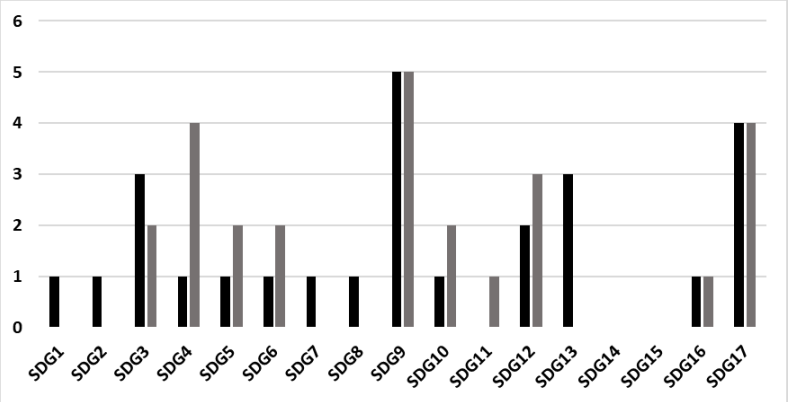


Figure 2. Number of times that SDGx is significant in the linear regression models of the overall score per dimension (KPIs) by taking SDGx as a quantitative variable (black) and a dummy variable (gray).

The international outlook score evidenced a positive significant effect on the number of students and the continents of Europe and Oceania. Reporting information about gender equality (*dSDG5*) indicated a positive relation with the international outlook score. The positive impact of *dSDG5* suggests international demand for transparency about gender equality.

As regards the SDGs, the score for industry, innovation, and infrastructure (SDG9) evidenced a positive significant effect on the five models, whereas partnerships (SDG17) did so with four of the five models (teaching, research, citations, industry income) (Table 7).

Teaching was particularly and positively aligned with SDG9, SDG17, and climate action (SDG13). Along with research, in addition to SDG9 and SDG17, health (SDG3) and climate action (SDG13) had a positive effect on the score. Apart from SDG 9 and SDG 17, the citations score was positively related to health (SDG3), education (SDG4), and responsible consumption and production (SDG12), but negatively to peace and justice (SDG16), whereas industry income was positively related to water (SDG6) and decent work and economic growth (SDG8).

Finally, we obtained some interesting results when studying the relation between SDGs and subjects (Table 8). On the one hand, arts and humanities (languages, literature and linguistics, history, philosophy and theology, art, performing arts and design, archaeology, architecture) were the subjects with the poorest relation with the SDGs, as these subjects were aligned only with two SDGs: SDG9 and SDG 7.

On the other hand, as regards the most repeated SDGs to be aligned with subjects, SDG9 and SDG17 were noteworthy, and were positively associated with all the subjects except law. Second, SDG13 was also positively associated with four of the five analyzed technological sciences subjects, but was not significantly related to social sciences and humanities (Table 8).

Table 8. Linear regression models per subject.

Panel A	Technological Sciences									
	Computer Science		Engineering and Technology		Clinical, Pre-Clinical and Health		Life Sciences		Physical Sciences	
Variable	Robust Coefficient	t	Robust Coefficient	t	Robust Coefficient	t	Robust Coefficient	t	Robust Coefficient	t
SDG1	−0.06	−0.96	−0.03	−0.63	−0.05	−0.85	−0.06	−0.79	−0.06	−1.01
SDG2	−0.01	−0.09	−0.05	−1.00	−0.01	−0.11	−0.05	−0.78	−0.06	−0.96
SDG3	0.01	0.31	0.01	0.30	0.18	5.32 ***	0.09	2.24 **	0.03	0.68
SDG4	0.04	1.08	0.08	2.41 **	−0.07	−1.78 *	−0.01	−0.25	0.06	1.66 *
SDG5	−0.02	−0.44	−0.08	−2.06 **	0.08	1.79 *	0.00	0.01	−0.05	−1.14
SDG6	−0.14	−1.49	−0.01	−0.16	−0.07	−0.76	−0.23	−2.24 **	0.00	−0.03
SDG7	0.10	1.16	0.12	1.85 *	0.03	0.50	0.11	1.54	0.00	0.06
SDG8	−0.02	−0.39	0.04	1.08	0.01	0.25	0.02	0.48	0.04	0.87
SDG9	0.26	7.15 ***	0.29	9.43 ***	0.21	6.06 ***	0.33	8.94 ***	0.24	7.32 ***
SDG10	0.05	1.02	0.03	0.54	0.00	−0.07	0.04	0.61	0.07	1.36
SDG11	−0.07	−1.29	−0.06	−1.36	−0.02	−0.40	−0.06	−0.93	−0.02	−0.35
SDG12	−0.02	−0.60	0.02	0.67	0.03	0.91	0.06	1.33	0.06	1.61
SDG13	0.12	2.79 ***	0.08	2.13 **	0.06	1.39	0.11	2.44 **	0.11	2.47 **
SDG14	−0.11	−1.29	−0.01	−0.18	−0.04	−0.58	0.12	1.69 *	0.03	0.37
SDG15	0.14	1.74 *	−0.04	−0.67	−0.01	−0.14	−0.06	−0.84	−0.04	−0.62
SDG16	0.07	1.42	0.02	0.37	0.01	0.15	−0.01	−0.25	−0.04	−0.74
SDG17	0.08	2.34 **	0.07	2.42 **	0.11	4.24 ***	0.08	2.43 **	0.08	2.66 ***
dSDG1	4.30	1.13	1.65	0.63	2.01	0.60	−1.68	−0.37	4.26	1.39
dSDG2	−4.95	−1.08	−0.60	−0.19	−1.67	−0.48	0.90	0.20	0.16	0.04
dSDG3	0.95	0.39	−0.10	−0.05	−11.32	−4.72 ***	−3.83	−1.46	−1.57	−0.67
dSDG4	−2.80	−1.02	−5.95	−2.83 ***	1.55	0.68	−1.31	−0.46	−6.47	−2.74 ***
dSDG5	1.98	0.75	5.19	2.36 **	−2.71	−1.06	1.61	0.51	4.29	1.82 *
dSDG6	7.65	1.65 *	−0.20	−0.05	5.11	1.10	13.28	2.41 **	−1.94	−0.44
dSDG7	−5.62	−1.07	−2.88	−0.70	−3.94	−1.00	−6.68	−1.43	0.58	0.13
dSDG8	4.30	1.51	−0.35	−0.15	1.64	0.74	−1.15	−0.38	−0.49	−0.20
dSDG9	−12.88	−5.69 ***		−6.75 ***	−10.38	−5.21 ***	−14.32	−6.33 ***	−9.99	−4.89 ***
dSDG10	−3.88	−1.45	−0.93	−0.37	−1.59	−0.61	−1.37	−0.44	−3.59	−1.38
dSDG11	5.98	1.75 *	5.23	1.91 *	3.41	1.04	5.23	1.35	1.11	0.35
dSDG12	−0.77	−0.31	−3.60	−1.80 *	−0.91	−0.42	−2.52	−0.98	−4.66	−2.09 **
dSDG13	−5.94	−2.34 **	−3.00	−1.45	−2.54	−1.01	−6.31	−2.25 **	−4.09	−1.62
dSDG14	5.50	0.83	−1.86	−0.45	1.01	0.22	−9.16	−1.85 *	−1.22	−0.26
dSDG15	−6.88	−1.05	2.99	0.77	2.34	0.53	6.04	1.25	3.37	0.74
dSDG16	−4.67	−1.49	−1.15	−0.42	−1.07	−0.34	1.67	0.43	2.68	0.83
dSDG17	−10.75	−4.80 ***	−10.57	−5.99 ***	−11.14	−6.04 ***	−12.58	−5.17 ***	−9.22	−4.67 ***
N of Students	0.00	−0.67	0.00	−0.30	0.00	−0.43	0.00	−4.04 ***	0.00	−3.07 ***
Year	2.08	2.35 ***	−1.07	−1.34	−1.62	−2.09 **	−0.44	−0.48	−0.66	−0.86
NorthAmerica	19.19	10.05 ***	16.01	10.23 ***	6.71	3.88 ***	16.85	8.53 ***	19.42	12.35 ***
SouthAmerica	−2.84	−1.59	−6.75	−4.77 ***	−7.87	−4.71 ***	−6.75	−3.55 ***	−5.31	−3.56 ***
Asia	3.62	2.08 **	2.32	1.75 *	−4.73	−3.08 ***	0.42	0.22	2.34	1.71 *
Europe	10.47	6.34 ***	7.18	5.57 ***	0.72	0.49	12.08	6.54 ***	12.91	9.53 ***
Oceania	15.46	6.87 ***	17.33	9.29 ***	4.55	2.24 **	18.84	8.13 ***	19.87	9.93 ***

Cons	−4179.98	−2.33 **	2188.93	1.36	3305.29	2.11 **	921.68	0.49	1369.96	0.88
N	1568		1912		1498		1572		2018	
F	18.91 (0.0000) ***		24.14 (0.0000) ***		15.28 (0.0000) ***		29.43 (0.0000) ***		29.60 (0.0000) ***	
R-squared	0.2449		0.2492		0.2423		0.3163		0.2950	

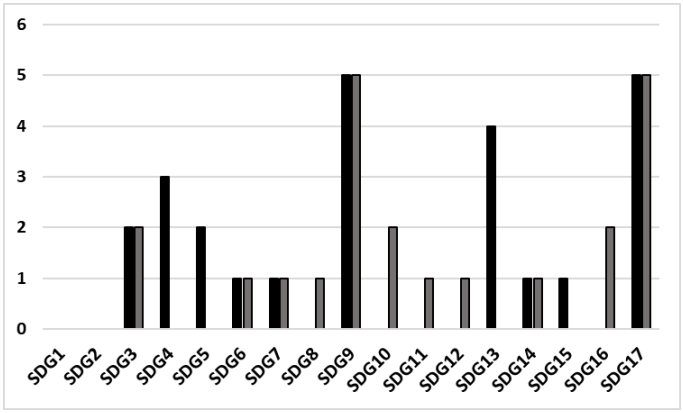
Panel B	**Social Sciences and Humanities**											
	Psychology		**Arts and Humanities**		**Education**		**Law**		**Social Sciences**		**Business and Economics**	
Variable	**Robust Coefficient**	**t**	**Robust Coefficient**	**t**	**Robust Coefficient**	**t**	**Robust Coefficient**	**t**	**Robust Coefficient**	**t**	**Robust Coefficient**	**t**
SDG1	−0.05	−0.48	0.04	0.36	0.06	0.57	0.12	0.47	0.03	0.33	0.01	0.13
SDG2	0.09	0.95	−0.06	−0.51	−0.07	−0.73	−0.17	−0.85	−0.03	−0.40	−0.02	−0.27
SDG3	0.11	2.00 **	0.07	1.19	0.07	0.93	0.34	2.13 **	−0.04	−0.68	0.06	1.29
SDG4	−0.07	−1.08	−0.01	−0.18	−0.10	−1.38	−0.21	−0.80	0.00	0.01	−0.02	−0.37
SDG5	0.10	1.31	−0.02	−0.21	0.08	1.01	−0.08	−0.37	−0.03	−0.39	−0.07	−1.17
SDG6	−0.06	−0.39	−0.16	−1.20	−0.26	−2.02 **	−0.01	−0.04	−0.07	−0.63	−0.10	−0.77
SDG7	0.17	1.58	0.09	1.00	0.15	1.51	0.54	2.05 **	0.05	0.66	0.05	0.49
SDG8	−0.12	−1.97 *	0.01	0.24	0.00	−0.04	−0.04	−0.30	−0.07	−1.00	−0.01	−0.24
SDG9	0.23	5.24 ***	0.24	5.16 ***	0.26	5.94 ***	0.03	0.27	0.26	5.96 ***	0.24	6.42 ***
SDG10	−0.11	−1.51	0.04	0.55	0.07	0.89	0.06	0.31	0.16	2.18 **	0.17	2.85 **
SDG11	−0.14	−1.76 *	−0.10	−1.46	0.04	0.41	0.22	1.12	−0.01	−0.13	−0.06	−0.89
SDG12	0.01	0.12	0.04	0.70	−0.14	−2.04 **	−0.12	−0.64	0.02	0.28	0.01	0.28
SDG13	0.08	1.47	0.08	1.54	0.08	1.41	0.08	0.65	0.03	0.47	0.06	1.15
SDG14	−0.03	−0.24	−0.05	−0.38	−0.02	−0.12	−0.53	−1.97 **	−0.02	−0.22	−0.12	−1.14
SDG15	0.16	1.51	0.13	1.05	0.20	1.60	0.38	1.42	−0.03	−0.41	0.08	0.86
SDG16	0.09	1.25	0.07	1.08	0.16	1.74 *	−0.14	−0.76	0.16	2.36 **	0.04	0.76
SDG17	0.08	1.79 *	0.10	2.46 **	0.12	2.36 **	−0.01	−0.13	0.11	2.37 **	0.09	2.54 **
dSDG1	0.34	0.05	−1.52	−0.23	−7.72	−1.29	−6.12	−0.31	−2.36	−0.47	−4.88	−1.00
dSDG2	−4.93	−0.84	1.51	0.21	4.64	0.85	11.39	0.74	−0.25	−0.05	1.59	0.32
dSDG3	−7.20	−1.76 *	−4.52	−1.16	−0.25	−0.05	−21.36	−1.68 *	2.64	0.64	−3.39	−1.04
dSDG4	0.30	0.06	−0.40	−0.10	3.90	0.78	16.86	0.98	−3.15	−0.80	−0.52	−0.14
dSDG5	−3.19	−0.62	2.87	0.59	−2.67	−0.53	3.95	0.26	4.21	0.85	5.51	1.46
dSDG6	−1.04	−0.13	5.91	0.94	13.38	2.00 **	−4.25	−0.35	4.73	0.76	3.98	0.55
dSDG7	−9.97	−1.45	−8.10	−1.39	−8.36	−1.37	−37.15	−1.82 *	−0.60	−0.12	−1.05	−0.16
dSDG8	5.86	1.56	−0.11	−0.03	0.19	0.05	−6.04	−0.63	3.29	0.67	0.95	0.29
dSDG9	−11.94	−3.93 ***	−11.50	−4.08 ***	−13.13	−4.21 ***	0.26	0.03	−14.79	−4.82 ***	−11.83	−4.48 ***
dSDG10	5.91	1.29	−2.70	−0.66	−5.17	−1.18	−2.29	−0.17	−8.66	−2.02 **	−9.60	−2.92 ***
dSDG11	12.79	2.24 **	8.11	1.68 *	−1.49	−0.25	−14.59	−0.95	1.63	0.30	4.74	1.10
dSDG12	0.98	0.26	−4.44	−1.33	9.79	2.17 **	14.69	1.11	−3.31	−0.81	−2.46	−0.73
dSDG13	−7.45	−2.19 **	−2.95	−0.99	−4.13	−1.09	−6.71	−0.78	0.13	0.03	−1.44	−0.49
dSDG14	0.88	0.08	1.13	0.10	1.22	0.12	48.01	2.02 **	2.02	0.30	5.68	0.65
dSDG15	−3.93	−0.44	−3.50	−0.33	−11.92	−1.21	−31.93	−1.39	5.22	0.86	−3.16	−0.43
dSDG16	−6.14	−1.17	−3.50	−0.78	−12.91	−2.12 **	9.78	0.68	−11.33	−2.42 **	−1.05	−0.27
dSDG17	−7.60	−2.11 **	−10.70	−3.24 ***	−13.71	−3.51 ***	−4.44	−0.44	−12.98	−3.92 ***	−11.47	−4.03 ***
N of Students	0.00	0.46	0.00	0.81	0.00	0.08	0.00	−2.14 **	0.00	−0.92	0.00	−0.48
Year	−0.42	−0.41	−0.07	−0.07	−0.94	−0.77	−0.22	−0.10	−20.20	−16.78 ***	−0.80	−0.78
NorthAmerica	12.13	4.54 ***	8.88	4.03 ***	12.67	5.08 ***	9.58	2.47 **	11.62	4.11 **	14.96	6.80 ***
SouthAmerica	−6.95	−2.47 **	−4.79	−2.29 **	−5.00	−1.92 *	−1.34	−0.29	−4.96	−1.74 *	−3.99	−1.81 *

Asia	8.11	2.77 ***	2.59	1.16	11.82	4.17 ***	11.64	2.35 **	3.50	1.25	8.24	3.89 ***
Europe	5.68	2.19 **	7.56	3.66 ***	5.61	2.40 **	7.24	1.93 *	5.46	2.03 **	7.10	3.52 ***
Oceania	6.93	2.39 **	9.71	3.85 ***	9.85	3.72 ***	8.72	1.98 **	8.41	2.60 **	10.92	4.46 ***
Cons	877.14	0.43	174.72	0.08	1928.30	0.79	473.99	0.11	40,830.39	16.79 ***	1635.76	0.79
N	959		1175		905		379		912		1218	
F	7.70 (0.0000) ***		8.31 (0.0000) ***		7.73 (0.0000) ***		3.03 (0.0000) ***		20.00 (0.0000) ***		10.74 (0.0000) ***	
R-squared	0.1546		0.1040		0.1729		0.1030		0.3562		0.1513	

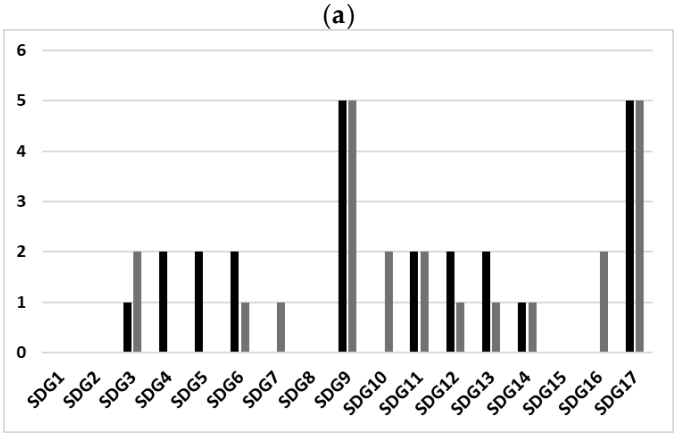
*, **, and *** represent a significant level of 10%, 5%, and 1%, respectively.

Of the control variables, continents significantly affected the 11 considered studies. All the models were globally significant at 1%, and they had more explanatory power in technological sciences (more than 24%) than in social sciences and humanities (R^2, Table 8).

As Figure 3 shows, SDG 9 and SDG 17 were the most relevant and constant SDGs in both technological sciences and social sciences and humanities. They were also significant in all the models except law in both their quantitative and dummy versions.



(**a**)



(**b**)

Figure 3. Number of times that SDGx is significant in the linear regression models per subject when taking SDGx as (**a**) a quantitative variable and (**b**) a dummy variable. Legend: technological sciences in black, social sciences and humanities in gray.

Robustness tests were performed. When replicating the models under the 1% winsorization in both tails [70] of all the dependent and independent variables, their sign and significance remained constant for the estimated models. However, the variables that were previously significant at 10% were no longer significant, which was the case of SDG13 in the research score and the international outlook score models. The same occurred with variables SDG14 and SDG16, which were no longer significant in the life sciences subject and education subject model, respectively.

3.3. Logistic Regression Analysis

Motivated by the very few institutions reporting SDG information to THE, in this section we assessed whether the best ranked universities were less willing to disclose SDG information (Rh5), and whether there was any gender influence on the degree of transparency shown by HEIs (RH6).

As Table 9 shows, the models for SDG7 and SDG14 were not reported because they were not globally significant. SDG15 (life on land) was not related to the variables included in the model, and therefore we concluded that HEIs' decision to report data about SDG15 was driven by some different factors not included in the model.

Table 9. Logit regression models.

Panel A	**SDG1**		**SDG2**		**SDG3**		**SDG4**		**SDG5**	
	Coefficient	**z**	**Coefficient**	**z**	**Coefficient**	**z**	**Coefficient**	**z**	**Coefficient**	**z**
Overall	−0.01	−2.14 **	−0.01	−1.89 *	−0.01	−1.66 *	−0.02	−3.71 ***	−0.01	−2.59 ***
North America	−1.05	−2.77 ***	−0.63	−1.65 *	−1.16	−4.74 ***	−0.84	−3.36 ***	−0.96	−3.75 ***
South America	0.13	0.34	0.13	0.31	−0.47	−1.80 *	−0.22	−0.83	−0.53	−1.92 *
Asia	−0.39	−1.17	−0.28	−0.79	−0.72	−3.24 ***	−0.53	−2.31 **	−0.62	−2.71 ***
Europe	−0.63	−1.95 *	−0.56	−1.62 *	−0.86	−3.95 ***	−0.51	−2.24 **	−0.67	−2.98 ***
Oceania	−0.53	−1.00	0.11	0.23	0.17	0.55	0.38	1.20	0.44	1.40
N of Students	0.00	0.70	0.00	1.65 *	0.00	0.60	0.00	2.2 **	0.00	0.48
Female_percentage	−0.01	−0.01	0.04	0.06	1.80	4.45 ***	1.05	2.65 ***	0.67	1.65 *
Year	omitted		omitted		0.33	3.64 ***	0.27	2.96 ***	0.40	4.12 ***
Top 500	−0.01	−0.03	0.15	0.51	0.00	0.01	0.01	0.05	0.12	0.69
Cons	−0.58	−1.19	−1.01	−2.01 **	−662.95	−3.64 ***	−536.18	−2.96 ***	−806.16	−4.12 ***
N	1331		1331		2533		2533		2533	
LR chi²	35.48 (0.0000) ***		24.70 (0.0033) **		103.84 (0.0000) ***		120.24 (0.0000) ***		77.90 (0.0000) ***	
Panel B	**SDG6**		**SDG8**		**SDG9**		**SDG10**		**SDG11**	
	Coefficient	**z**	**Coefficient**	**z**	**Coefficient**	**z**	**Coefficient**	**z**	**Coefficient**	**z**
Overall	−0.01	−0.86	−0.01	−2.56 ***	−0.02	−2.87 ***	−0.01	−2.50 **	−0.01	−2.08 **
North America	−0.82	−2.15 **	−0.95	−3.47 ***	−0.78	−3.00 ***	−0.54	−1.94 *	−0.44	−1.65 *
South America	−0.51	−1.23	−0.42	−1.43	−0.39	−1.36	0.06	0.21	−0.18	−0.61
Asia	−0.37	−1.09	−0.42	−1.71 *	−0.30	−1.27	−0.29	−1.15	−0.31	−1.25
Europe	−0.83	−2.43 **	−0.45	−1.88 *	−0.37	−1.70 *	−0.31	−1.24	−0.32	−1.34
Oceania	−0.14	−0.28	0.45	1.36	−0.33	−0.96	1.00	3.02 ***	0.48	1.45
N of Students	0.00	−0.09	0.00	0.05	0.00	−0.07	0.00	0.26	0.00	−0.03
Female_percentage	−0.31	−0.51	0.13	0.3	−0.85	−2.15 **	0.45	1.02	−0.02	−0.05
Year	omitted		0.47	4.59 ***	0.35	3.71 ***	0.48	4.68 ***	0.48	4.87 ***
Top 500	0.11	0.4	0.25	1.35	0.37	2.11 **	0.27	0.47	0.02	0.11
Cons	−0.60	−1.18	−940.34	−4.60 ***	−706.29	−3.71 ***	−976.31	−4.69 ***	−968.24	−4.88 ***
N	1331		2533		2533		2533		2533	
LR chi2	17.59 (0.0402) ***		66.60 (0.0000) ***		49.82 (0.0000) **		78.45 (0.0000) ***		44.40 (0.0000) ***	

Panel C	SDG12		SDG13		SDG15		SDG16		SDG17	
	Coeffi-cient	z	Coeffi-cient	z	Coeffi-cient	z	Coeffi-cient	z	Coeffi-cient	z
Overall_score	−0.01	−1.96 ***	−0.01	−1.80 *	−0.01	−1.34	−0.01	−2.55 **	−0.02	−3.14 ***
North America	−0.26	−0.85	−0.60	−2.14 **	−0.25	−0.51	−0.84	−3.10 ***	−0.83	−3.35 ***
South America	0.08	0.24	−0.37	−1.18	0.56	1.12	−0.18	−0.63	−0.35	−1.28
Asia	0.02	0.05	−0.37	−1.44	0.46	1.03	−0.47	−1.93 *	−0.46	−1.98 **
Europe	−0.02	−0.08	−0.33	−1.31	0.09	0.20	−0.42	−1.77 *	−0.48	−2.10 **
Oceania	0.37	0.98	0.01	0.04	0.87	1.51	0.26	0.79	0.66	2.08 **
N of Students	0.00	0.07	0.00	−0.04	0.00	−0.36	0.00	1.28	0.00	2.23 **
Female_percentage	−0.13	−0.27	−0.21	−0.47	0.40	0.61	0.97	2.16 **	0.61	1.65 *
Year	0.42	3.92 ***	0.33	3.18 ***	omitted		0.54	5.27 ***	0.50	5.77 ***
Top 500	0.26	1.32	0.24	1.24	0.24	0.80	0.21	1.13	−0.02	−0.10
Cons	−856.45	−3.93 ***	−670.63	−3.18 ***	−1.84	−3.04 ***	−1099.19	−5.28 ***	−1,011.12	−5.77
N	2533		2533		1331		2533		2533	
LR chi²	27.17 (0.0024) ***		22.93 (0.0110) ***		18.48 (0.0300) ***		76.11 (0.0000) **		134.12 (0.0000) ***	

*, ** and *** represent a significant level of 10%, 5%, and 1%, respectively.

Our results (Table 9) revealed a negative effect of the *overall score* on 15 of the 17 SDGs, except for water (SDG6) and climate action (SDG15). This suggests that as universities did not perceivef an alignment between the *general overall ranking* and the SDGs, they were not motivated to disclose such information. However, when the *Top 500* variable was included to identify the best-ranked universities, it was positively significant in SDG9, even when the overall score was negative. Accordingly, the universities ranked in the *Top 500* perceived stakeholders' interest in the industry SDG and disclosed that information, which coincided with the SDG9 impact on all subjects save law (Table 8).

The effect that the percentage of female students had on transparency (Rh6) was positively significant for SDG3, SDG4, SDG5, SDG16, and SDG17, but negative for SDG9.

4. Discussion and Conclusions

Higher education institutions are responsible for addressing socioeconomic transformation. This paper analyzed the impact of HEIs' disclosure of SDG achievements to the THE ranking indicator. As far as we know, this is the first empirical research work to merge a university global indicator such as THE with a sustainability indicator of HEIs based on their SDG progress to measure the extent to which the SDGs are related to the best universities' overall rankings. To date, the aim of university rankings has only been to evaluate universities' academic and research reputation or their performance for promotion purposes [71,72], which does not necessarily mean that HEIs make any societal contribution [73–75]. In fact, as part of the metric management model included in the higher education system worldwide, university leaders have carefully paid attention to the quantitative metrics considered by international rankings (QS World Ranking, Shanghai Ranking, The World University Ranking, Scimago Institutions Ranking), such as the citation indicators in research evaluation and funding [73–76], whereas other qualitative dimensions, e.g., HEIs' societal contribution, have been neglected. If this were true, then HEIs' leaders would be responsible for promoting elitism instead of equity and diversity through performance-based incentives [50,76–78].

In this context, our study sheds light on HEIs' sustainability engagement and achievements worldwide based on the underlying assumption of the MMM applied by HEIs [50,77–79]. This is why we merged the two indicator types built by THE to assess university performance against the SDGs to raise awareness about having to make improvements in most HEIs.

By performing a descriptive statistical analysis with the sample for the 2019–2020 period, we verified HEIs' growing interest in reporting their SDG achievements. The number of HEIs revealing their SDG actions increased by 54% in 2020 from the previous year. We also found that SDG17 (partnerships), SDG4 (quality of education), SDG3 (good health and well-being), SDG9 (industry, innovation, and infrastructure), and SDG5 (gender equality) obtained the most submissions from institutions. It was not surprising to find that the fewest participating institutions were related to SDG14 (life below water), SDG15 (life on land), SDG2 (zero hunger), and SDG 6 (clean water and sanitation). The selection of which SDGs to submit to THE partly reflects an institution's profile, mission, and discipline strengths. Geographical location also plays a role in the chosen disclosed SDG achievements. Our study evidenced the geographical differences among HEIs' overall scores. Indeed, the HEIs located in North America and Oceania obtained the highest values, whereas South American universities received the lowest average values. This situation might be related to countries' socioeconomic situations. Heleta and Bargus [80] critically pointed out in their study how the SDGs lack targets to ensure reforming and rebuilding HEIs in low-income countries as a prerequisite for inclusive socioeconomic sustainable development.

The modeling results revealed how mainly SDG9, and SDG3, SDG13, SDG12, and SDG4 to a lesser extent, positively increased the obtained general ranking score. In other words, the more positive actions related to industry, innovation, and infrastructure; responsible consumption; and production and climate action were, the higher the position a university occupies in the general ranking was. Furthermore, a higher percentage of international students promoted a higher overall general ranking score.

We also tested whether there were any significant differences for the impact of the reported SDG information on the overall score among quartiles. Quartile 1 was particularly relevant and evidenced a positive effect for SDG16, followed by SDG9, and a negative effect for research of education as a science and the promotion of inclusive education (SDG4). This would indicate that the overall ranking favors HEIs at the top positions as being more committed to transferring knowledge to industry (SDG9) and to supporting domestic institutions that guarantee peace and social justice (SDG16).

In the analysis, performed to know how the SDGs were differently related to per-dimension SDGs, the score for industry, innovation, and infrastructure (SDG9) evidenced a positive significant effect on four of the five models (teaching, research, citations, industry income). It was also verified that the female ratio increased HEIs' probability of reporting their SDG actions for health and education (SDG3 and SDG4), but lowered the probability of reporting SDG9. Our results also showed that the universities ranked in the *Top 500* perceived stakeholders' interest in the industry SDG and disclosed that information, which coincided with the SDG 9 impact on all subjects save law. In contrast, the effect that the percentage of female students had on transparency was negatively significant for SDG 9 and positive for SDG3, SDG4, SDG5, SDG16, and SDG17.

This study represents a novel contribution to the existing literature and bridges the gap in the literature about the lack of assessments of SDG transparency and performance globally achieved by HEIs. As previously mentioned, sustainability reporting in higher education is still in its early days when considering both quantity and quality [38–40]. In addition, the literature on SDG reporting by HEIs is limited to single case studies and lacks empirical information. As far as we are aware, this is the first empirical analysis to merge universities' SDG achievements with a global score ranking indicator. This study supports accountability in HEIs implementing SDG actions by making gaps in HEIs' progress toward SDG achievement visible.

Our study provides insights into a topic that has been under researched, that of the relation between HEIs' position and reputation and their transparency in reporting their SDG achievements. University rankings can certainly be most influential. They can help prospective students to narrow down their choice of institution and, of course, they also

promote universities. Less tangible activities performed by universities with societal values must be reported and communicated continuously exactly as firms do in their corporate sustainability reports [80].

This is the first empirical study to analyze HEIs' level of reporting in terms of SDG achievements and to compare HEIs worldwide according to their willingness to report their sustainability actions. This study allows HEI managers to assess and compare their organizations to the benchmark and to better understand existing differences. Hence, this study can be considered a useful tool for HEIs' strategic planning to enhance the integration of the SDGs into different university core areas. Indeed, by reading this study, an HEI manager may find some room for thought about how to apply sustainability principles to all university activity dimensions, from teaching and research to internationalization, communication, and reporting.

Although the corporate management literature has widely investigated this matter, the integration of sustainability reporting into the overall management of HEIs is still hard work [37]. Universities disclose voluntary information about SDG achievements to better manage their stakeholders' expectations and to build their reputation. The pressure is on HEIs to be transparent when reporting their SDG outcomes, and to incorporate them into their strategic planning. However, HEIs including the SDGs is not a task for HEIs' leaders to manage themselves. Higher education policymakers should provide sustainability reporting guidelines for HEIs to mainstream sustainability efforts in the Higher education sector [39,81–84]. As [81] highlighted, it is relevant that HEIs and higher education networks all around the world find ways to engage with low-income countries and their institutions so they are not left too far behind by 2030.

Our research has its limitations. We first relied on secondary data sources, such as those published by THE. Second, available information was lacking. Our study only analyzed two years (2019, 2020) and included the 17 SDGs for 2020 (11 for 2019). In addition, the disclosure of SDG achievements was decided by each university. Thus, working on submitting information to this ranking requires teams of individuals who work on submissions, compile evidence, and ensure that it is publicly visible on websites, as failure to do so means losing points. This suggests that institutions with fewer resources cannot afford full-on participation and need to moderate the expectations of how well they are likely to perform in this ranking. Moreover, the fact that HEIs self-report data, as [76] stated, highlights the issue of institutions' reliability. Further analyses of how HEIs have evolved over time in incorporating the SDGs is necessary. Future research should incorporate other variables related to HEIs' age, economic resources, and climate change variables.

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