

Analysis of the performance of the best participating universities in the World University ranking - Times Higher Education (THE)¹

Análise do desempenho das principais universidades que participam no World University Rankings -
Times Higher Education (THE)

Análisis del rendimiento de las mejores universidades participantes en el ranking World University –
Times Higher Education (THE)

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Abstract: Global university rankings are important indicators that measure the ability of universities to positively impact society. This study aimed to analyze the determining factors in the academic performance and sustainability of universities across participating continents in THE Ranking. Regarding the methodology, it is classified as a descriptive, quantitative study that considered the Gross Domestic Product (GDP) and the sustainability level of the countries where the universities are in the analysis of academic performance. This performance was measured through the World University Rankings by Times Higher Education (THE). The main findings are as follows: a strong relationship was found between country-level characteristics such as GDP, HDI, and the scores in the Times Higher Education World University Rankings, suggesting that the characteristics of the country influence the performance and sustainability level of each university. Similarly, research and teaching groups have the most impact on the overall score of the top university.

Keywords: sustainability; performance; universities.

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Resumo: Rankings universitários globais são importantes indicadores, que medem a capacidade das universidades de impactar a sociedade positivamente. Neste estudo, teve como objetivo analisar os fatores determinantes no desempenho acadêmico e de sustentabilidade das universidades por continentes participantes do Ranking THE. Quanto ao método, classifica-se como um estudo de descritivo, quantitativo, que considerou para análises o Produto Interno Bruto, e o nível de Sustentabilidade dos países em que as universidades se situam - no desempenho acadêmico das Universidades, mensurado por meio do ranking World University da Times Higher Education (THE). Como principais resultados, destacam-se: verificou-se uma forte relação entre as características em nível de país como PIB, IDH e a Pontuação no World University Rankings do Times Higher Education, o que sugere que as características do país influenciam no desempenho e no nível de sustentabilidade de cada universidade. Do mesmo modo, os grupos pesquisa e ensino são os mais impactantes a Pontuação Geral de melhor universidade.

Palavras-chave: sustentabilidade; desempenho; universidades.

Resumen: Los rankings universitarios globales son indicadores importantes que miden la capacidad de las universidades para impactar positivamente en la sociedad. Este estudio tuvo como objetivo analizar los factores determinantes del rendimiento académico y la sostenibilidad de las universidades por continentes participantes en el Ranking THE. En términos de metodología, se clasifica como un estudio descriptivo y cuantitativo que consideró el Producto Interno Bruto (PIB) y el nivel de sostenibilidad de los países donde se encuentran las universidades. El rendimiento académico de las universidades se midió a través del ranking World University de Times Higher Education (THE). Los principales resultados destacan una fuerte relación entre las características a nivel de país, como el PIB, el Índice de Desarrollo Humano (IDH) y la puntuación en el World University Rankings de Times Higher Education, lo que sugiere que las características del país influyen en el rendimiento y nivel de sostenibilidad de cada universidad. Asimismo, los grupos de investigación y enseñanza tienen el mayor impacto en la puntuación general de la mejor universidad.

Palabras clave: sostenibilidad; rendimiento; universidades.

1 Introduction

Valdés, Correa, and Mellado (2018), the 2030 Agenda for Sustainable Development, which took place in 2015 in the United States, composed of several world leaders, demonstrates the reality and urgency to ally the pillars of Education for Sustainable Development (ESD) at all levels of education.

Sustainable development is achieved when governed by the 17 Sustainable Development Goals (SDGs), to which education is one of the key and fundamental points to contribute to more sustainable, socially just and egalitarian societies. (LOZANO *et al.*, 2019).

In view of this, educating society regarding the environment is paramount to leverage this process and one of the essential contexts for this is Higher Education, as one of the ways to find answers to new demands and current sustainability issues. (ALBA, 2017).

It is incumbent on all organizations and sectors to be actively and deeply involved in sustainability issues. A key type of organization that plays a significant role in addressing sustainability issues are Higher Education Institutions, which impact various sectors, people, and organizations with their research and studies. Many of these HEIs have incorporated environmental education and education for sustainable development (ESD) into their systems (including education, research, campus operations, community outreach, assessment, and reporting), making Sustainable Development (SD) an integral part of the institutional framework by collaborating with other HEIs (RAMOS *et al.*, 2015). However, it is still a huge challenge to improve sustainable practices across campus and in all areas.

Thus, ranking the level of sustainability and academic performance is important in order to prove and measure the evolution of countries, regions and even universities and organizations in achieving improvements that positively impact the world. Not least, it is worth mentioning that the educational sector has much to contribute to the ecological balance, since in addition to playing the role of raising awareness of future generations in decision-making, it is also a kind of model for the whole society (OLIVEIRA; OLIVEIRA; ROHRICH, 2016). It is then realized that educational institutions must participate in the discussion on environmental management, as they have great potential to seek solutions to the problems pertinent to the environment that surrounds them (ARAÚJO; FREITAS; ROCHA, 2017). And regardless of whether a Higher Education Institution (HEI) has a public or private character, presenting sustainable practices can be a relevant characteristic in front of other HEIs (OLIVEIRA; OLIVEIRA; ROHRICH, 2016). A university is considered "sustainable" or "green" when it realizes sustainability in all its dimensions, especially in teaching, research, extension and management. (AVILA, *et al.*, 2017).

In view of the above, this article aims to analyze the determining factors in the academic and sustainability performance of universities by continents participating in the THE Ranking.

2 Universities: main concepts

Education plays a key role in the formation of the citizen, since its goal goes beyond transmitting intellectual knowledge, so that assists in the formation of an individual's character, as well as physical and psychological development. The personal and professional training of each human being will be his guide will accompany him throughout life, as its principles related to ethical awareness and social and environmental concern. (MIRANDA, SCHIER, 2016).

Silva (2009) corroborates that the university has a key role in the issue of sustainability and environmental preservation, while it is not only a place of human and professional training, because it performs through research centers solutions to minimize environmental degradation processes that society faces. Universities have the responsibility of teaching, researching, and serving as a model for the community. Therefore, these institutions have a significant responsibility, and need to practice the teachings they apply in preparing new generations to achieve a more sustainable future.

Avila *et al.*, (2017), a sustainable and competitive campus must associate the structure of teaching, research and organizational management with education aimed at sustainability, so that the internal and external communities recognize this need and begin to practice the promotion of life and well-being of current and future generations, which also results in positive returns to this institution.

Ecological planning has little result if there is no conscious participation of teachers, employees and students who make up the university community. (GONZÁLEZ-GAUDIANO; MEIRACARTEA; MARTÍNEZ-FERNÁNDEZ, 2015).

It is also present in universities the concern with the dispute to improve their score in world rankings. Given the above, to increase the competitiveness of a university, problems on how to increase the overall strength of the university, improve the quality of teaching, and cultivate highly qualified talent have attracted the attention of university administrators. (TREVISANI, 2019).

Thus, given the importance of Higher Education Institutions, one realizes some justifications of why to use ratings in higher education institutions: Rapid globalization of higher education, the internationalization of higher education or even to encourage institutions to participate in broader national and international discussions and to promote collaboration, such as research partnerships, student and faculty exchange programs. (PAVEL, 2015).

Moreover, country-level characteristics can have a good relationship with a university's ranking among the best in the world. As such, country-level qualities explain the choice of variables representing a country's particularities (HDI, GDP) used in this study, as there is a relationship between a country's levels of education and growth. (CHIPINDO, 2019).

3 Sustainability in universities

Sustainability in universities plays a vital role in the development of science, programs, and projects. It is one of the areas that has been growing for decades, especially through the development of international agendas, such as the MDGs (Millennium Development Goals) in the 2000s and, more recently, the SDGs (Sustainable Development Goals).

The SDGs, in 2015, realizing that the economic, social, and environmental indicators of recent years did not meet all the purposes for the environment and the future of the next generations, the United Nations (UN) proposed that its 193 member countries sign the 2030 Agenda, a global plan consisting of 17 goals (SDGs) and 169 targets for these countries to achieve sustainable development in all areas by 2030. (AVILA, *et al.*, 2017).

It is noteworthy that higher education plays a dual role in achieving all 17 SDGs. One aspect is the integration of Sustainable Development issues into academic and research programs and projects. The other is the ability of Higher Education to promote them and enable their implementation in business and the community. (SALIMOVA; SOLDATOVA, 2021).

Due to this importance of Higher Education Institutions - HEIs, for Wright and Wilton (2012), the development achieved by universities in relation to sustainability, gain representativeness. Studies with the theme of sustainable development have increased year after year. Thus, there is the perception of managers of these organizations of universities that the most evident issues for the effectiveness of sustainability, in large part, would be to promote sustainability initiatives on university campuses.

Although it has been an issue for some time, the 70's, sustainability is a challenge to the usual models of teaching, since there is not in their structures, an education focused on the discipline of "sustainability". (WRIGHT; WILTON, 2012).

However, students should learn sustainability values and carry them forward in their lives and, especially, in their professional careers (ATMACA, 2017), perpetuating sustainable skills and knowledge acquired during their academic career. Thus, environmental education should be present in the training of all professionals and

students working in universities, even if there are restrictions and obstacles in the implementation of sustainability in curricula and in the university environment.

Even with difficulties in the transformation towards becoming a green university, higher education has made much progress in terms of incorporating sustainable development at all levels in institutions, research based on sustainable development, curricula for sustainability, and increasing collaboration among stakeholders in society (SALIMOVA; SOLDATOVA, 2021). And while universities are required to comply with the guidelines set by public and private international entities, they need to know their students to plan more effective interventions, acting to make the curriculum more attractive and manage the campus in its sustainable issues. (ALBA, 2017).

Thus, it is important to emphasize that the multidisciplinary of sustainability covering various areas of knowledge is beneficial about different ways and perceptions of solving problems of unsustainability. Realizing the importance of sustainability in HEIs, several research have advanced on the subject:

León-Fernández and Domínguez-Vilches (2015) analyzed the implementation of environmental management and sustainability in Spanish universities. The research concluded that the Spanish University System follows the following international trends as permanent working structures, environmental and sustainability management tools, as well as other activities related to the environment and sustainable development.

Zhao and Zou (2015) examined green initiatives in China, where they conducted a case study with document analysis and observations. It was found that the green university principle in Tsinghua is divided into three dimensions: green education, green research, and green campus.

Wu *et al.* (2015) explored sustainability in higher education curricula in Asia. It was found that universities in Asia should add an international connection and actively participate in sustainable education on digital platforms.

Pereira *et al.* (2014) analyzed the relationship between environmental management practices developed on a campus of the University of São Paulo (USP). The authors noted that USP's environmental management program is limited by the university's own internal bureaucracy and management power (command hierarchy).

4 Sustainability indicators in universities

The world ranking of universities has been receiving increased attention in recent times, as it is one of the most important methods of higher education evaluation and has the largest role in the development of higher education policy, restructuring and goal setting. (ASHOUR, 2019).

Thus, the claim to measure and periodically check their level of achievement and the establishment of universities' goals in sustainable development has led to the need to identify, measure and evaluate sustainability indicators (CASTRO; REIS; SILVA, 2017). This has led to a race to compete in world university rankings, indicating a propensity of scientific universities in recent times towards the topic. (ASHOUR, 2019).

However, even today, despite the advancement of the topic, there are few sustainability indicators in universities. Among them, the THE ratings stand out, which seek to capture the full range of a global university activities: research, teaching and other subareas. (MIWA *et al.*, 2014).

As for the Green Metric indicator, the UI GreenMetric World University Ranking is an initiative of the University of Indonesia that was launched in 2010. As part of its strategy to raise its international standing, the University hosted an International Conference on World University Rankings. (GREENMETRIC, 2011).

And, with the need for a uniform system that would be suitable to attract the support of thousands of universities worldwide and where the results would be based on a numerical score that would allow ranking for quick comparisons among them, according to the criteria of their commitments to sustainability issues and environmental impact the Green Metric is one of the best-known indicators. (LIMA *et al.*, 2022).

Another important university sustainability metric is the Shanghai Rankings, also called the Academic Ranking of World Universities (ARWU). The platform is recognized as the forerunner of global university rankings. ARWU presents the world's top 1,000 research universities annually based on transparent methodology and objective third-party data (SHANGAI RANKINGS, 2020). Another important metric is the National Taiwan University (NTU) Ranking, in which the ranking characteristics are that quality indicators account for 75% of the score. (NTU RANINGS, 2021).

It is emphasized that this ranking system is based solely on the qualitative and quantitative performance of scientific articles. It does not assess the university's overall performance in teaching, research, and administration. It also takes the emphasis off the performance indices used in other ranking systems that represent subjectively perceived reputations and outstanding achievements.

5 Methodology

This research is classified as descriptive research, documental, and with a quantitative approach. It is essential to mention the country-level characteristics used in this study: According to the Brazilian Institute of Geography and Statistics (IBGE, 2021), Gross Domestic Product (GDP) is defined as the total of goods and services produced for final consumption, corresponding to the sum of the values added by the various economic activities plus taxes (net of subsidies) on products. It represents the sum of the wealth generated by the various economically active sectors in each region and period. The GDP is the sum of all the final goods and services produced by a country, state, or city, usually in one year. All countries calculate their GDP in their respective currencies. (IBGE, 2021).

The GDP, being an economic indicator, helps to understand factors such as income distribution, quality of life, education, and health. In addition, we have the Human Development Index. The concept of human development was born defined as a process of expanding people's choices so that they have the capabilities and opportunities to be what they want to be. (PNUD, 2021).

Unlike the economic growth perspective, which views the well-being of a society only by the resources or the income it can generate, the human development approach seeks to look directly at people, their opportunities and capabilities.

As for the HEIs, through the Times Higher Education metric, the level of adherence of universities about sustainability and the performance of these HEIs is measured.

Indicators are used to provide a comprehensive and balanced comparison in four major areas: research, administration, extension, and teaching. In addition, data on Gross Domestic Product (GDP), Human Development Index (HDI) and Sustainability Level (SLE) of the countries was used for the top ranked universities per continent in the Times Higher Education World Ranking Index.

For data collection, websites of the International Monetary Fund, the United Nations Development Program, the Times Higher Education website were used. Data were also collected from the research bases of the UFSM Library, Capes, Science Direct, and others. Two different analyses were performed in this study.

The first one seeks to analyze the level of correlation existing between these study variables, with the Times Higher Education Rankings being the Dependent variable studied and the GDP, the level of sustainability of the countries, the GDP per capita and HDI being the independent variables of the study in question. Thus, the descriptive methodology type is used, which aims to characterize a certain phenomenon and describe the characteristics of a certain population (GIL, 2007). It is

essential to mention that the HDI used was that of the year 2019, since, at the time of data collection, data for the year 2020 were not yet available.

The Environmental Performance Index (EPI) is a metric that serves to measure and classify a country's environmental performance. It measures the level of sustainability of countries. It is also worth mentioning the GDP per capita, in which the per capita income is obtained by dividing the National Income by the number of inhabitants of the country. The second analysis, on the other hand, seeks to investigate the influence of the groups that make up the index and to highlight which have the greatest impact on the results of the best universities in the world.

The object of this study comprised samples of the top 10 universities by continent for the year 2020 in the Times Highest Education World University Ranking. In addition, afterwards, analyses were made using the best universities in Brazil according to the Ranking in the year 2020.

It was decided to perform Spearman's Correlation to evaluate the correlation between the study variables. First the relationship between country-level characteristics and the Times Highest Education World Ranking score (identified by THE scores) was evaluated. Next, a correlation was performed between the groups that make up the THE Score and this overall THE Score score. Spearman's correlation coefficient, also known as Spearman's ordinal correlation coefficient, which range between -1 and +1 and do not depend on the units of measurement of the variables, which facilitates their interpretation. (SOUSA, 2019).

Subsequently, it was decided to perform cluster analysis to measure the influence of some variables on THE's World University Ranking Score.

6 Results and analysis

According to the data obtained, Table 1 was prepared to better show the THE score in the levels of teaching, research, citations, industrial income and international perspective in each country and continent.

Table 1 - Top 10 universities by continent

Country	Continent	Universitie	THE Score	Teachin g	Research	Citation s	Income Industry	Internationa l Outlook
UK	Europe	University of	95,4	90,5	99,6	98,4	65,5	96,4
USA	America	Inst. de Tecn. da Califórnia	94,5	92,1	97,2	97,9	88	82,5
USA	America	University of Cambridge	94,4	91,4	98,7	95,8	59,3	95
USA	America	University of Stanford	94,3	92,8	96,4	99,9	66,2	79,5
USA	America	Inst. Tecn. Massachusetts	93,6	90,5	92,4	99,5	86,9	89
USA	America	University of Princenton	93,2	90,3	96,3	98,8	58,6	81,1
USA	America	University of Harvard	93	89,2	98,6	99,1	47,3	76,3
USA	America	University of Yale	91,7	92	94,8	97,3	52,4	68,7
USA	America	University of Chicago	90,2	89,1	91,4	96,7	52,7	76
UK	America	Imperial College	89,8	84,5	87,6	97	69,9	97,1
USA	America	University of Pensilvânia	89,6	87,5	90,4	98,2	74	65
USA	America	Johns Hopkins	89,2	81,7	91,4	98,3	91,3	73,2
USA	America	University of Califórnia	88,3	83	90,6	99,2	46,1	70,4
S SWITZERL AND	Europe	Eth Zurich University	88,3	81,8	92,8	90,3	56,8	98,2
UK	Europe	Ucl University	87,1	77,8	88,7	96,1	42,7	96,2
China	Asia	University of Tsing	82,6	86,6	94	74,6	100	47,4
China	Asia	University of Pequim	82,3	89,1	90	73,2	86,6	59,6
Singapore	Asia	Cing University	81,9	76,8	90,4	76,9	58,8	95,5
UK	Europe	London University	81,3	69	83	92,8	35,1	93,2
UK	Europe	University of Edimburgo	79,4	67,3	74,1	96,4	38,9	93,8

Germany	Europe	Lm Munic University	77,8	68,4	77	88,8	100	67,2
Australia	Oceania	University of Melbourne	77,8	65,9	74,1	89,8	76,3	93,1
China	Asia	University of Hong Kong	75,9	69,5	77,2	76,6	59,7	98,6
Japan	Asia	University of Tóquio	75,7	85,9	89,6	60,7	77,4	38,2
UK	Europe	Kings College	75,7	61,3	68,5	94,8	45,6	95,6
SWITZERLAND	Europe	Lausanne Institute of Technology	75,4	66,6	66,3	88,3	66,4	98,6
China	Asia	University of Hong Kong	73,1	57,4	66,1	89,8	71,9	97,7
Singapore	Asia	University of Tecnológico of Nanyang	72,9	57,6	70,4	84,9	76,5	95,1
Australia	Oceania	University of Australia	72,1	54,4	69,7	88,4	46,4	95,5
China	Asia	University of Chinese of Hong Kong	69,6	55,8	62,8	84,5	55,2	97,8
China	Asia	University of Sidney	69,3	51	61,5	90,7	67,7	89,2
Australia	Oceania	University of Seoul	68	72,3	71,6	66,5	86,6	35,8
Japan	Asia	University of Kyoto	67,7	73,7	78,1	59,9	66,2	33,7
Australia	Oceania	University of Queensland	67,4	49,3	58,7	86,8	80,9	92,5
Australia	Oceania	UNSW Sydney University	65,9	50,2	58,2	82,9	57,9	93,7
Australia	Oceania	University of Monash	64,7	47,3	56,6	83,8	67,2	89,9
Australia	Oceania	University of Adelaide	59,9	34,3	41,6	95,3	64,8	91,7
South Africa	Africa	University of Cabo	58,2	33,2	42,8	90,3	85,3	81,8
New Zealand	Oceania	University of Auckland	55,2	31,4	43,9	80,2	62,4	94
Australia	Oceania	University of technology of Queensland	55,2	31,9	40,3	86,4	62,4	81,4
Australia	Oceania	University of Canberra	54,1	25,2	31,1	99,2	38,6	86,9
South Africa	Africa	University of Witwatersrand	54	31,2	43,2	78,8	100	73,7
South Africa	Africa	University of Stellenbosch	48,45	29,5	34,6	74,4	59,1	54,8
Egypt	Africa	University of	40,55	11,9	8,7	100	34,4	44,6

		Aswan						
Nigeria	Africa	University of Covenat	40,55	27,2	14,7	78,4	43,8	26,2
South Africa	Africa	University of Kwazulu	40,55	25,4	28,7	70,1	36,8	55
Egypt	Africa	University of Mansoura	40,55	19,1	9,2	88,1	39,6	44,3
Nigeria	Africa	University of Ibadan	37	23,4	12,1	77,6	41,4	37,1
South Africa	Africa	University of North-West	37	20,1	17,1	69,9	41,1	43,3
Egypt	Africa	University of Suez	37	19,9	8,7	82,6	37,9	46

Source: The authors.

However, in view of the above, the best placed universities in the Ranking, are European or from the Americas, more specifically from the United States of America. The results show that universities with greater investment potential obtain better results, as well as their high impact courses, research and international partnerships.

After conducting descriptive analysis separating the sample of universities in quartiles, the THE score is the factor that classifies them in determining quartile as shown in the table next.

Table 2 - Quartiles as per THE's World Rankings scores

Cluster	World University Ranking	Classification
Cluster 1	From 88.30 to 99.40	Tops
Cluster 2	From 75.55 to 88.29	High Performance
Cluster 3	58.20 to 75.54	Regular performance
Cluster 4	37 to 58.19	Low performance

Source: The authors.

This table 3 reveals at a significance level of 0.01 that there is a good correlation between universities' scores in the Times Higher Education World Ranking and all variables, meaning that universities located in countries with high GDP, EPI, HDI scores tend to rank higher in the THE World Ranking metric's best universities score.

Table 3 - Correlation between Pont. THE and characteristic variables at country level

Variables	THE Scores	GPD in trillions	EPI	HDI	GDP per capita
THE Scores	1,0000	0,6330	0,5631	0,6812	0,6493
GPD in trillions	0,6330	1,0000	0,1760	0,1690	0,2474
EPI	0,5631	-0,1760	1,0000	0,9167	0,7187
HDI	0,6812	0,1690	0,9167	1,0000	0,8525
GDP per capita	0,6493	0,2474	0,7187	0,8525	1,0000

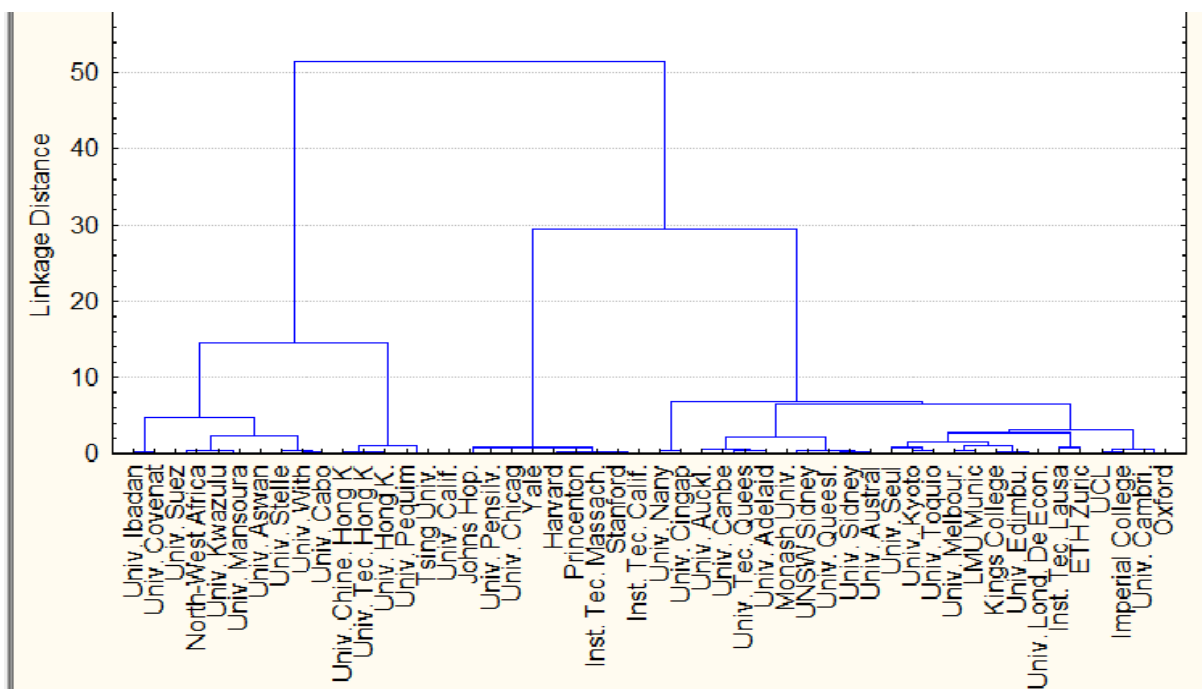
Note: Data in red represent significant correlation between variables. $P < 0,01$.

Source: The authors.

One can infer from these cluster analyses a large disparity between universities on the African continent (Covenant University, Suez Canal University, among others and those in Europe such as Oxford, Cambridge, etc. This can be explained by the different level of scores in their Times Higher Education World Rankings.

Furthermore, a certain similarity can be seen about the scores between some universities in Oceania, such as Melbourne and the Australian National University, and others in Europe, such as King's College and the University of Edinburgh. Moreover, by analyzing Figure 1, one can see a greater correlation between the overall THE score and the GDP of the country to which the university belongs. It is worth noting that this can be explained because countries with more resources tend to invest more in universities. Thus, universities in countries with higher GDP (and higher investment in research by universities) have a higher score of best universities according to THE's World University Ranking.

Figure 1 - Cluster analysis considering country-level variables and THE Score - Cases of all universities



Source: The authors.

In the following Table 4, the importance of each group in the THE Ranking score is presented. For this question, we chose to analyze the factors that make up the score of the Times Higher Education World Ranking. Among them the factors Teaching and Research stand out as having the most impact.

Table 4 - Importance of each group in THE's World Ranking score

Variables	THE Scores	Teaching	Research	Citations	International Perspective	Industry Income
THE Scores	1,0000	0,9610	0,9772	0,4804	0,4964	0,3452
Teaching	0,9610	1,0000	0,9767	0,2792	0,2808	0,3652
Research	0,9772	0,9767	1,0000	0,2954	0,4151	0,3961
Citations	0,4804	0,2792	0,2954	1,0000	0,5358	-0,1370
International Outlook	0,4964	0,2808	0,4151	0,5358	1,0000	0,0565
Industry Income	0,3452	0,3652	0,3961	-0,1370	0,0565	1,0000

Note: Data in red indicate significance at $p < 0.01$.

Source: The authors.

Table 5 presents the best universities in Brazil in 2020, and the variable Research is the one that most impacts the result of the Score of the best universities in THE's World University Ranking. It is worth noting that the best positions of universities are mostly due to better scores in the Research group, followed by the Teaching group. Furthermore, it is worth mentioning that UFSM and UF São Carlos, have low scores in these two groups and in the overall score, if compared to the best in the world, and should focus on improving these groups to then improve their score in this ranking and become a university with better academic performance and sustainability. We note that the Research subgroup is composed of the sub-indexes: Research Reputation: 18%, Research Income: 6% and Research Productivity: 6%. The Teaching group is composed of the sub-indexes: Research Reputation: 15%, Staff to Student Ratio: 4.5%, PhD to Bachelor Ratio: 2.25%, PhD / Academic Staff Ratio: 6% and Institutional Income: 2.25%.

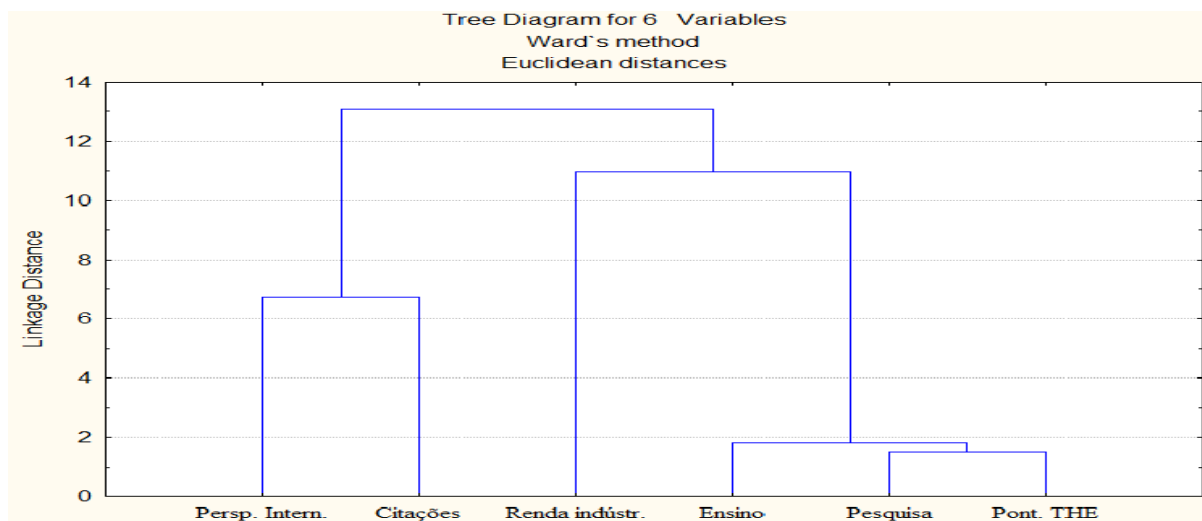
Table 5 - Top universities in Brazil in 2020

University	Overall score	Teaching	Research	Citations	Industry Income	International Perspective	THE Ranking
USP	48,45	56,4	54	40,6	39,9	33,9	251-300
Unifesp	31,75	32,6	17,8	43,3	35,7	28,6	601-800
UFRJ	25,2	34,4	22	26,1	35,5	28,7	601-800
PUC-Rio	31,75	27,4	25,6	27,9	99,5	41,5	601-800
UFRGS	31,75	29,6	18,3	49,3	46,5	26,3	601-800
UFSC	31,75	28,4	13,1	52,6	38,7	29,4	601-800
UNB	25,2	25,8	14,4	36,8	34,5	30,9	801-1000
Unicamp	37	44,6	38	34,8	44,8	30,6	801-1000
UFPEl	25,2	17,9	11	48,6	34,4	20	801-1000
UFPE	16,4	26,9	9,2	14,3	35,9	35,9	+ 1001
UFC	16,4	22,4	11,8	20,7	38,6	25,8	+ 1001
UFPR	16,4	24,4	11,5	12,7	35,1	22,2	+ 1001
UFBA	16,4	21,8	13,7	18,7	34,4	23,9	+ 1001
UF São Carlos	16,4	26,2	13,4	17,3	41,2	24,5	+ 1001
UFSM	16,4	20,4	8,8	13,5	35	17,4	+ 1001

Source: The authors.

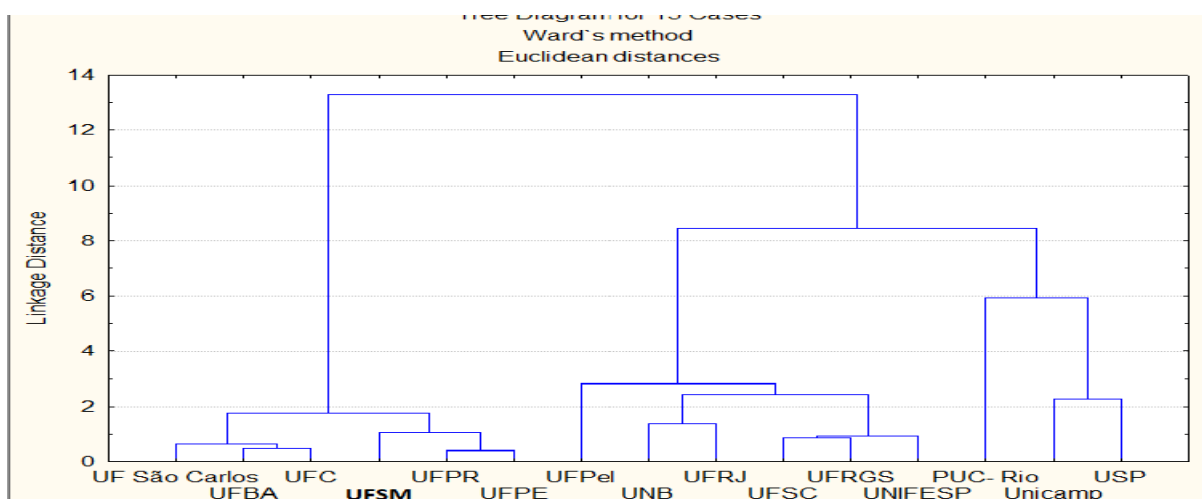
It is worth noting from the cluster analysis above that some universities stand out ahead like USP, due in large part to the difference between their THE Ranking scores. UFSM is somewhat similar to UFPR and UFPE.

Figure 2 - Cluster of the groups that make up the THE score



Source: The authors.

Figure 3 - Brazilian universities cluster

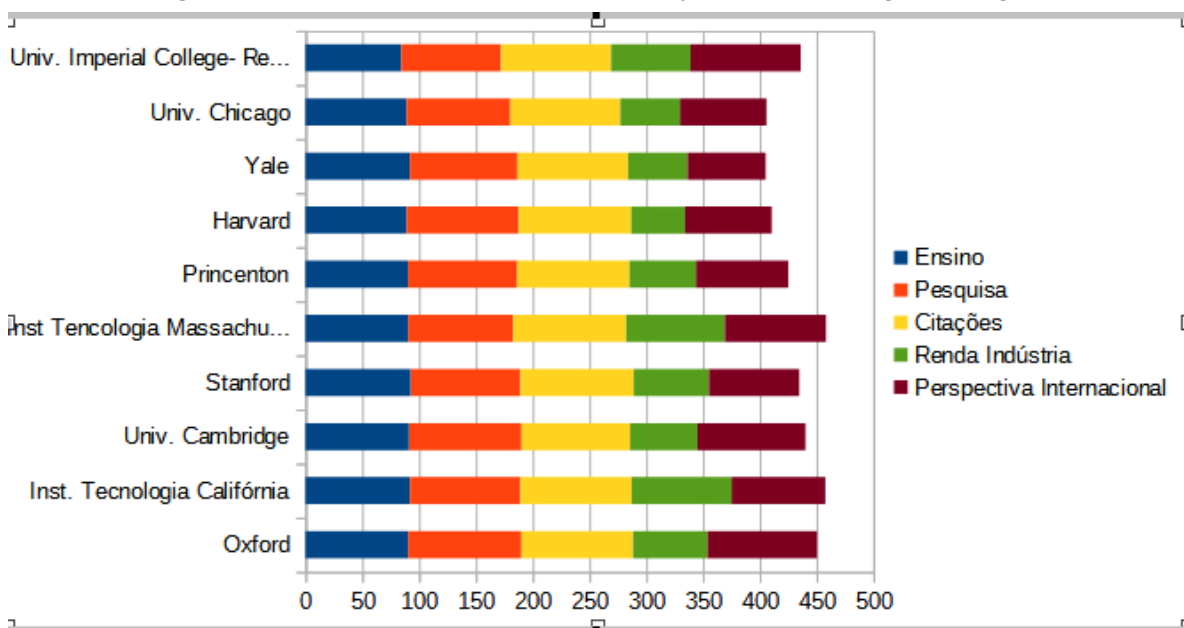


Source: The authors.

Among the tables presented in the methodology was the descriptive statistics of the variables THE World University Rankings, GDP, HDI and Sustainability Level of the country (EPI). It was found a good correlation between the variable THE World University Rankings (PON THE) and the variables GDP, EPI (level of sustainability of the country to which the university belongs) and IDH, indicating that these last three exert a significant influence on the variable THE World University Rankings (PON THE). Moreover, by the cluster analysis it was perceived a great similarity between universities on the same continent and huge disparities between universities on the African continent and most universities in North America, Europe.

As for the groups that make up the score of the World University Rankings (PON THE), by analyzing the previous tables, it can be seen that the variables Research and Teaching are the ones that most impact the result of the score of the best universities in the World University Rankings of the THE.

Figure 4 - Top universities in the world-by-World Rankings score group



Source: The authors.

The top 10 universities have a high score mainly in the groups Teaching and Research, which suggests that Brazilian universities should focus their efforts mainly on these variables. It is important that the university invest in the aspects that make up the Research variable of the university, such as reputation research, which analyzes a university's reputation for research excellence among its peers. It is also paramount to advance in the productivity aspect, which is evaluated by THE by counting the number of publications published in academic journals indexed by Elsevier's Scopus database per academic, scaled to institutional size and normalized for subject matter. (BATI, 2014).

According to university sustainability and performance metrics, it can provide insight into the university's ability to publish articles in quality peer-reviewed journals. (GENG et al., 2013). It is also indicated that HEIs should improve their academic reputation. In this way, they will be able to improve their performance in the World University ranking - THE. Furthermore, the environmental ranking at the country level strengthens the positive impact of sustainability on the academic performance of universities. This is corroborated by some studies (ATICI, 2020; JABBOUR et al., 2013; SAVELY et al., 2007). Thus, it is suggested that the country invest more in quality of education, whether in adult literacy and in the levels of schooling of the population in general and improve sustainability at the country level, since, as we have seen, these indicators impact on the quality of universities.

7 Conclusions

The objective of the article is to analyze the determinants in the academic and sustainability performance of universities by continents participating in THE Ranking. Based on the results presented, we can conclude that the factors reveal a number of important insights. In examining the different continents, it was observed that each region faces unique challenges, but also shares distinct characteristics and similar drivers.

First, it was identified that financial investment is a crucial factor for the academic performance and sustainability of universities on all continents. Universities that have access to adequate financial resources tend to perform better in terms of infrastructure, research, qualified faculty, and sustainability programs. The availability of funding is related to the capacity of funding partnerships, government investments, and resources with companies. Investments also allow the exchange of knowledge and collaboration between institutions, which can boost academic excellence, innovation, and strengthen sustainability policies.

Another principal factor is the emphasis on diversity and inclusion. Universities that value diversity in all its forms, including ethnic, cultural, and gender diversity, tend to be more likely to achieve strong academic performance and promote sustainable practices.

However, it is necessary to recognize that each continent has its own characteristics and contextual challenges. For example, lack of equal access to education in some continents can be a significant obstacle to the academic performance and sustainability of universities. Therefore, policies and strategies adapted to local realities are essential to drive significant improvements on each continent.

In sum, the analysis of the determinants in the academic performance and sustainability of universities by continents participating in THE Ranking highlights the

importance of adequate funding, strategic collaboration, valuing diversity and inclusion as key elements in driving the success of higher education institutions around the world. These factors must be considered by policymakers and the universities themselves to promote a quality and sustainable educational and research environment on a global scale.

Limitations of the study include the fact that it uses the top 10 universities per continent. Furthermore, the inclusion of control variables at the university level (such as university budgets) would be of excellent value and would improve the robustness of the results.

It is suggested for future studies: a) a more holistic approach on the independent variables addressed, being able to take into consideration other aspects of great relevance to an educational institution such as resource management and intellectual capital, encompassing research that complements and supports the research presented; b) comparative analysis between countries within each continent: conduct a more detailed analysis of the determinants of academic performance and sustainability in each country within a specific continent. This would identify differences and similarities in the challenges and drivers faced by each nation and provide valuable insights for policies and strategies for educational improvement; c) longitudinal study: conduct a longitudinal study to track the academic and sustainability performance of universities over time. This would allow to assess the effectiveness of implemented interventions and policies, identify emerging trends, and better understand the relationship between the analyzed factors; d) in-depth qualitative analysis: complement the quantitative approach with an in-depth qualitative analysis. This would involve conducting interviews, surveys, or case studies with relevant stakeholders such as faculty, students, university administrators, government representatives, and members of civil society. This approach would enable more detailed insights into the perceptions, challenges and opportunities associated with academic and sustainability performance in different continental contexts.

References

- ALBA, D. Hacia una fundamentación de la sostenibilidad en la educación superior. **Revista Iberoamericana de Educación**, Madrid (España), v. 73, p. 15-34, 2017. Disponível em: <https://rieoei.org/RIE/article/view/197>. Acesso em: 11 ago. 2023.
- ARAUJO, M. A.; FREITAS, L. S.; ROCHA, V. S. G. Gestão ambiental: práticas sustentáveis nos campi de uma IFES. **Reunir – Revista de Administração, Ciências Contábeis e Sustentabilidade**, Campina Grande, v. 7, n. 3, p. 36-50, dez. 2017. Disponível em: <https://reunir.revistas.ufcg.edu.br/index.php/uacc/article/view/672>. Acesso em: 11 ago. 2023.

ASHOUR, M. A. H. Improve the ranking of Arab universities in the world universities rankings. **American Journal of Environmental and Resource Economics**, USA, v. 4, n. 3, p. 110-115, 2019. Disponível em:

<https://www.sciencepublishinggroup.com/journal/paperinfo?journalid=295&doi=10.11648/j.ajere.20190403.14> . Acesso em: 11 ago. 2023.

ATICI, K.; YASAYACAK, G.; YILDIZ, Y.; ULUCAN, A. Green university and academic performance: an empirical study on UI greenmetric and world university rankings. **Journal of Cleaner Production**, USA, v. 291, abr. 2020. Disponível em:

<https://www.sciencedirect.com/science/article/abs/pii/S0959652620353348?via%3Dihub> . Acesso em: 11 ago. 2023.

ATMACA, C. Efeitos dos fatores contextuais na Educação Superior na formação de professores. **Vozes**, Curitiba, v. 1, p. 77-93, 2017.

AVILA, L. V.; LEAL FILHO, V.; BRANDLI, L. L.; MACGREGOR, C.; MOLTHAN-HILL, P.; ÖZUYAR, P.; MOREIRA, R. M. Barriers to innovation and sustainability at universities around the world.

Journal of Cleaner Production, USA, v. 164, p. 1268-1278, out. 2017. Disponível em:

<https://www.sciencedirect.com/science/article/abs/pii/S0959652617314531>. Acesso em: 11 ago. 2023.

BATY, Phil. The times higher education world university rankings, 2004-2012. *Ethics in Science and Environmental Politics*, USA, v. 13, n. 2, pág. 125-130, maio 2014. Disponível em:

https://www.researchgate.net/publication/271253325_The_Times_Higher_Education_World_University_Rankings_2004-2012. Acesso em: 11 ago. 2023.

CASTRO, A.; REIS, L. M. M.; SILVA, R. G. Indicadores ambientais de sustentabilidade para uma instituição federal de ensino superior. **Confins: revista franco-brasileira de geografia**, Skola Biznisa, n. 30, fev. 2017. Disponível em: <https://journals.openedition.org/confins/11812>.

Acesso em: 10 jan. 2022.

CHIPINDO, P. C. M. A educação como fator de desenvolvimento humano. **RAC: Revista Angolana de Ciências**, Huambo (Angola), v. 1, n. 1, 6 Jun, p. 197-207, jan./jun. 2019.

Disponível em: <http://publicacoes.scientia.co.ao/ojs2/index.php/rac/article/view/16>. Acesso em: 11 ago. 2023.

GIL, A. C. **Como elaborar projetos de pesquisa**. São Paulo: Atlas, 2007. p. 43

GONZÁLEZ-GAUDIANO, Edgar; MEIRA-CARTEA, P. A.; MARTÍNEZ-FERNÁNDEZ, C. N.

Sustentabilidad y universidad: retos, ritos y posibles rutas. **Revista de la Educación Superior**, México, v. 44, n. 175, p. 69-93, 2015.

GREENMETRIC, U. I. **University of Indonesia GreenMetric**. World University Rankings. 2019.

Disponível em: <http://greenmetric.ui.ac.id>. Acesso em: 04 jul. 2021.

IBGE. Instituto Brasileiro de Geografia e Estatística. **Produto Interno Bruto - PIB**. 2021.

Disponível em: <https://www.ibge.gov.br/explica/pib.php>. Acesso em: 17 jul. 2021.

LEÓN-FERNÁNDEZ, Y.; DOMÍNGUEZ-VILCHES, E. Environmental management and sustainability in higher education: the case of Spanish universities. **International Journal of Sustainability in Higher Education**, Leeds (England), v. 16, n. 4, p. 440-455, 2015. Disponível em: <https://www.emerald.com/insight/content/doi/10.1108/IJSHE-07-2013-0084/full/html>. Acesso em: 17 jul. 2021.

LIMA, C. D. S.; KIELING, D. L.; ÁVILA, L.; PAÇO, A.; ZONATTO, V. C. D. S. Towards sustainable development: a systematic review of the past decade's literature on the social, environment and governance and universities in Latin America. **International Journal of Sustainability in Higher Education**, Leeds (England), v. 24, n. 2, p. 279-298, march, 2022. Disponível em: <https://www.emerald.com/insight/content/doi/10.1108/IJSHE-09-2021-0394/full/html>. Acesso em: 11 ago. 2023.

LOZANO, R.; BARREIRO-GEN, M.; LOZANO, F. J.; SAMMALISTO, K. Teaching Sustainability in European Higher Education Institutions: assessing the connections between competences and pedagogical approaches. **Sustainability**, Basel (Switzerland), n. 11, p. 1602, 2019. Disponível em: <https://www.mdpi.com/2071-1050/11/6/1602>. Acesso em: 10 jan. 2022.

MIRANDA, L.; SCHIER, D. A Influência do Ensino de História na Educação Infantil e Formação do Aluno. **Educação em Foco**, São Paulo, n. 8, 2016.

MIWA, S; JOW, H; BATY, K; JOHNSON, A; CZAPIEWSKI, R; SARETZKI, G; TREUMANN, A; ZGLINICKI, T.V. Low abundance of the matrix arm of complex I in mitochondria predicts longevity in mice. **Nature communications**, USA, v. 5, n. 1, p. 1-12, may, 2014. Disponível em: <https://pubmed.ncbi.nlm.nih.gov/24815183/>. Acesso em: 11 ago. 2023.

NTU RANKINGS: performance ranking of scientific papers for world universities. Disponível em: <http://nturanking.csti.tw/>. Acesso em: 15 jun., 2021.

OLIVEIRA, P.; OLIVEIRA, B.; ROHRICH, S. Sustentabilidade em instituições de ensino superior: uma revisão sobre as conferências internacionais para a sustentabilidade. In: ENGEMA - Encontro Internacional sobre Gestão Empresarial e Meio Ambiente, 18., 2016, Paraná. **Anais** [...] Paraná: Engema, 2016. Disponível em: <https://engemausp.submissao.com.br/18/anais/arquivos/242.pdf>. Acesso em: 11 ago. 2023.

PAVEL, A. Global University Rankings: a comparative analysis. **Procedia Economics and Finance**, USA, n. 26, p. 54-63, dec. 2015. Disponível em: https://www.researchgate.net/publication/283237762_Global_University_Rankings_-_A_Comparative_Analysis. Acesso em: 11 ago. 2023.

PEREIRA, G. S. M.; JABBOUR, C.; OLIVEIRA, S. V. W. B.; TEIXEIRA, A. A. Greening the campus of a Brazilian university: cultural challenges. **International Journal of Sustainability in Higher Education**, Leeds (England), v. 15, n. 1, p. 34-47, 2014. Disponível em: <https://www.emerald.com/insight/content/doi/10.1108/IJSHE-10-2011-0067/full/html>. Acesso em: 11 ago. 2023.

PNUD, IPEA. Fundação João Pinheiro. **Atlas do desenvolvimento humano no Brasil**, 2021.

QS WORLD UNIVERSITY RANKINGS: rankings 2021. Disponível em:
<https://www.topuniversities.com/university-rankings/world-university-rankings/2022>. Acesso em: 18 jul., 2021.

RAMOS, T. B.; CAEIRO, S.; BART van HOOFF; LOZANO, R.; HUISINGHT, D.; CEULEMANS, K. Experiences from the implementation of sustainable development in higher education institutions: environmental management for sustainable universities. **Journal of Cleaner Production**, USA, n. 106, p. 03-10, 2015. Disponível em:
<https://repositorioaberto.uab.pt/bitstream/10400.2/111136/1/Ramosetal2015JCLP.pdf>. Acesso em: 11 ago. 2023.

SALIMOVA, T.; SOLDATOVA, E. Bringing PBL to Education for Sustainable Development: University to Business (U2B) approach. *In: International Symposium on Project Approaches in Engineering Education*. USA, p. 42-48, July, 2021. Disponível em:
https://www.researchgate.net/publication/353347425_Bringing_PBL_to_Education_for_Sustainable_Development_University_to_Business_U2B_approach. Acesso em: 11 ago. 2023.

SAVELY, S. M.; CARSON, A. I.; DELCLOS, G. L. An environmental management system implementation model for US colleges and universities. **Journal of Cleaner Production**, USA, v. 15, n. 7, p. 660-670, 2007. Disponível em:
https://www.researchgate.net/publication/223161738_An_environmental_management_system_implementation_model_for_US_colleges_and_universities. Acesso em: 11 ago. 2023.

SHANGAI RANKINGS: índice Shanghai Rankings, 2020. Disponível em:
<https://www.shanghairanking.com>. Acesso em: 26 maio 2021.

SILVA, M. **Complexidade da formação de professores**: saberes teóricos e saberes práticos. São Paulo: Editora UNESP; Cultura Acadêmica, 2009. 114 p.

SOUSA, A. Coeficiente de correlação de Pearson e coeficiente de correlação de Spearman: o que medem e em que situações devem ser utilizados? **Correio dos Açores**, Açores (Portugal), p.19, mar. 2019. Disponível em:
https://repositorio.uac.pt/bitstream/10400.3/5365/1/Sousa_CA_21%20Mar%c3%a7o%202019.pdf. Acesso em: 11 ago. 2023.

TREVISANI, F. M. A importância do feedback na visibilidade da aprendizagem. **Desafios da Educação**, São Paulo, 27 fev. 2019. Disponível em:
<https://desafiosdaeducacao.com.br/feedback-na-aprendizagem/>. Acesso em: 05 fev. 2022.

VALDÉS, H.; CORREA, C.; MELLADO, F. Proposed model of sustainable construction skills for engineers in Chile. **Sustainability**, Basel, Switzerland, v. 10, n. 9, p. 3093, ago. 2018. Disponível em: <https://www.mdpi.com/2071-1050/10/9/3093>. Acesso em: 11 ago. 2023.

WRIGHT, T. S. A.; WILTON, H. Facilities management director's conceptualizations of sustainability in higher education. **Journal of Cleaner Production**, USA, n. 31, p. 118 – 125, 2012. Disponível em:

https://www.researchgate.net/publication/271607525_Facilities_management_directors'_conceptualizations_of_sustainability_in_higher_education. Acesso em: 11 ago. 2023.

WU, Y. C. J.; SHEN, J. P.; KUO, T. An overview of management education for sustainability in Asia. **International Journal of Sustainability in Higher Education**, Leeds (England), v. 16, n. 3, p. 341-353, may 2015. Disponível em:

<https://www.emerald.com/insight/content/doi/10.1108/IJSHE-10-2013-0136/full/html>. Acesso em: 11 ago. 2023.

ZHAO, W.; ZOU, Y. Green university initiatives in China: a case of Tsinghua university.

International Journal of Sustainability in Higher Education, Leeds (England), v. 16, n. 4, p. 491-506, July 2015. Disponível em:

<https://www.emerald.com/insight/content/doi/10.1108/IJSHE-02-2014-0021/full/html>. Acesso em: 11 ago. 2023.

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