Sustainable Development Goals index: An analysis (2000-2022)

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In this international year of basic sciences for sustainable development and the edition of the special issue of challenges for sustainable development in the journal TJES. It is of interest to review how the sustainable development index has evolved according to the global fulfillment of the development goals (SDGs) in the world (2000-2022). It was found that since the Millennium Development Goals (MDGs) and subsequently the Sustainable Development Goals (SDGs) were proposed, the greatest increase in the index was reported in periods prior to the Covid-19 pandemic. Among the continents, the European continent is positioned with the highest SDGs index values, mainly the countries of Finland, Sweden, and Denmark (≥85 points). The continent with the lowest index is Africa (38-70). The values of the index in the years 2019-2022, present the highest positive correlation when comparing its value between the countries of each continent, i.e. COVID-19 period affected the progress of sustainable development. The current state of the indicator reflects that there are still countries in each continent where mechanisms must be generated to evolve in the fulfillment of the objectives set out in the 2030 agenda and thus increase the global index of sustainable development for the post-COVID-19 era.

Keywords: Sustainability, ???.

1 Introduction

Throughout the history of humanity, human beings have longed for a better world: without poverty, hunger, pain, equality, human rights, quality of life, quality of air, security, tolerance, love, understanding, justice, peace. In this sense, there have been several proposals, declarations, charters, programs, creation of various international organizations and conferences in search of these desires. In general, they have established actions to move towards these great human longings. The Declarations of the Rights of man and of the Citizen (legacy of the French Revolution in 1789), "Declaration of Human Rights" (UN, 1948), the creation of the League of Nations (created in the First World War, 1919) and the United Nations Organization (created at the end of the Second World War) [1-2] provide evidence of this.

In addition to the concerns for a better world in peace and the rights of man, as years went by, the concern for the environment was added. Thus, in 1968, the National Conference on Environmental Education was held in New Jersey-USA [3]. Likewise, Sweden's 1967-1968 intervention in the United Nations - the so-called "Swedish initiative" - led to the 1972 United Nations Conference on the Human Environment, which was the first to express the environment as a central issue of concern at the international level [4,5] Derived from this world conference was created 1) the United Nations Environment Programme (UNEP), and 2) International Environmental Education Program (IEEP), 3) 26 Basic Principles [3,6]. Through these programs, the goals related to peace, economic and social development, defense, and improvement of the environment is added. The principles adopted by the UN (1972) express the conviction that man has the obligation to protect and improve the environment for present and future generations; involving the responsibility of the people and their governments, where progress must prevail, but with discernment [7-9]. It is worth mentioning that this laid the foundations for what years later would be defined as sustainable development in the Brundtland Report (1987). In which it is understood as that sustainable development "is able to meet the needs of the present generation and does not have to compromise future generations" [10-12].

In addition to this reflection on environmental protection, in 1975 an International Seminar on Environmental Education was held in Belgrade to promote the inclusion of the environmental perspective in the educational area, elaborating the Belgrade Charter, which establishes the principles for environmental education [6, 13-14]. This is reflected in the need for nations to be able to grow, but without prejudice to the other and that the consumption of the individual does not occur to the detriment of others. Evidently, a need for a change in thinking that leads to a global ethic, an ethic of individuals and of society; an ethic that recognizes and responds with sensitivity to the complex and continuously evolving relationships between man and nature and with his fellows. The environmental goal is to form a world population aware of and concerned with the environment and associated problems. The objectives of environmental education are established: awareness, knowledge, attitudes, aptitudes, evaluation capacity and participation. Informal Education is considered necessary and permanent for the entire population, through mass media, articles, and dissemination. This type of education would be informal, in addition to the formal education received in educational institutions [3]. At the Rio de Janeiro conference (1992), the Stockholm principles were endorsed, although the role of women in environmental management and sustainable development, and of young people in achieving it and ensuring a better future for all, was also highlighted (Rio Janeiro, 1992) [3, 15,16].

In 2000, the UN established the six-millennium goals and in 2015, adopted the 2030 Agenda, with a set of 17 interlinked global Sustainable Development Goals (SDGs) [17]. This Agenda represents "a plan of action for people, planet and prosperity" and "seeks to strengthen universal peace in larger freedom". At the Stockholm conference (2022) [18], proposes to accelerate agenda 2030, the achievement of the sustainable development goals for a healthy planet, social and economic progress, well-being, and resilience. Thus, it is of interest to know how we are today, with the Sustainable Development Report (SDR) (Sachs et al., 2022) [19], being issued 50 years after 1) the environment was incorporated as a fundamental issue at the international level and 2) the results of the study prepared by a group of 17 researchers from MIT, headed by Donella Meadows (1941-2001), were published. In the document called "the limits of growth", the researchers project the behavior of variables such as population, pollution level, natural resources, total capital investment (industrialization), and food in 100 years [20-22].

Based on the model of the father of system dynamics Jay Forrester (1918-2016), the team´s Meadows project that the increase in population will cause a decrease in food and resources, pointing out the ecological crisis to which the human being was leading the planet with his actions [19,23]. In that preventive alert carried out in the 70's, added to new crises such as the Covid-19 pandemic, much remains to be done in our world.

But how are we doing in terms of sustainability in the continents? In times of COVID-19, there was progress of sustainable development, what happened in this period in relation to the global indicator of this parameter? From the recent comprehensive sustainable development report, we chose only to analyze the index of SDGs by country and by continent. Reflecting for each objective which countries are leading the

way in its fulfillment. Thus, the objective of this document is to analyze the behavior of the index in the five continents and to give us a global overview of how the countries are doing in each of the continents, integrating data from 2000 to 2022. Knowing their status is useful to continue rethinking and planning urgent present and future actions, and to assume the social and economic challenges and challenges that this implies.

2 Methodology

This analysis was based on the indicator representing an overall score (%) towards the fulfillment of the 17 SDGs (from the year 2000-2022) published in the Sustainable development report and interactive data from the website [19,24]. The index is expressed from 0-100, where if the overall score percentage is higher, it means that more sustainable development goals have been reached. The indicator analysis was performed for the five continents. The global scores of various countries on these continents (America (27 countries), Europe (43), Asia (38), Africa (40), and Oceania (3)) were used.

2.1 Statistical Analysis

Analysis of variance of the indicator between country values by continent for the years (2000, 2005, 2010, 2015, 2015, 2019, 2020, 2021, and 2022) and the least significant mean (LSD) comparison test were applied [25]. Finally, principal component analysis was applied to correlate the behavior of the indicator of the countries for each continent by year studied. SAS (2008), Project R and Fitopac procedures were used for the analysis [26-28].

3 Results and Discussion

SDG Index score per continent

Figure 1(a) shows the average values per continent of the SDG Index score (years 2000, 2005, 2010, 2015, 2019, 2021 and 2022-2022). It is possible to observe that the continent with the highest average SDG Index value, according to the countries considered, was Europe, and the lowest position was in Africa. The five continents present an evolution over time, finding the highest percentages of improvement for the years 2000, 2005, 2010, 2015 and 2019, i.e. the highest evolution has been achieved until before the Covid-19 pandemic. In the American continent, there was an improvement of 9.2% in the index from 2000 to 2022. Although it is noteworthy that the rate from 2019 to 2022, decreased by 0.3-0.4%. This means that during the pandemic there was a slowdown in relation to the improvement of the SDG index. In the case of the European continent, the improvement of the indicator from the beginning of the millennium (2000) to August (2022) is 8.68%.

During the pandemic, the indicator showed a slight increase (less than 0.5%). Likewise, Asia during the pandemic period tended to increase (0.5%). With respect to the year 2000 - 2022, it presented an increase in the indicator of 10.59%. It should be noted that the continent with the lowest average indicator values is Africa, although its improvement is the highest of the three continents (13.31%) from the beginning of the millennium to the present (2000-2022), with a growth in the pandemic period of 0.34%.

In relation to Oceania, there was the lowest improvement (3.5%) (according to the SDG index of the countries considered in this study). Likewise, in the pandemic period, the improvement was minimal, with 0.15, 0.26, and 0.27% for the years 2020, 2021 and 2022. Figure 1b shows the comparisons between continents. Statistically, significant differences are observed when comparing the mean values of the SDG index of the continents Oceania with Africa and Europe, and the comparisons between Africa with Asia, America, and finally when comparing Europe with Asia and America. Statistically, Oceania, Asia, and America have similar behavior, since they did not present significant statistical differences between their average index values for each continent in this period of time (2000-2022).

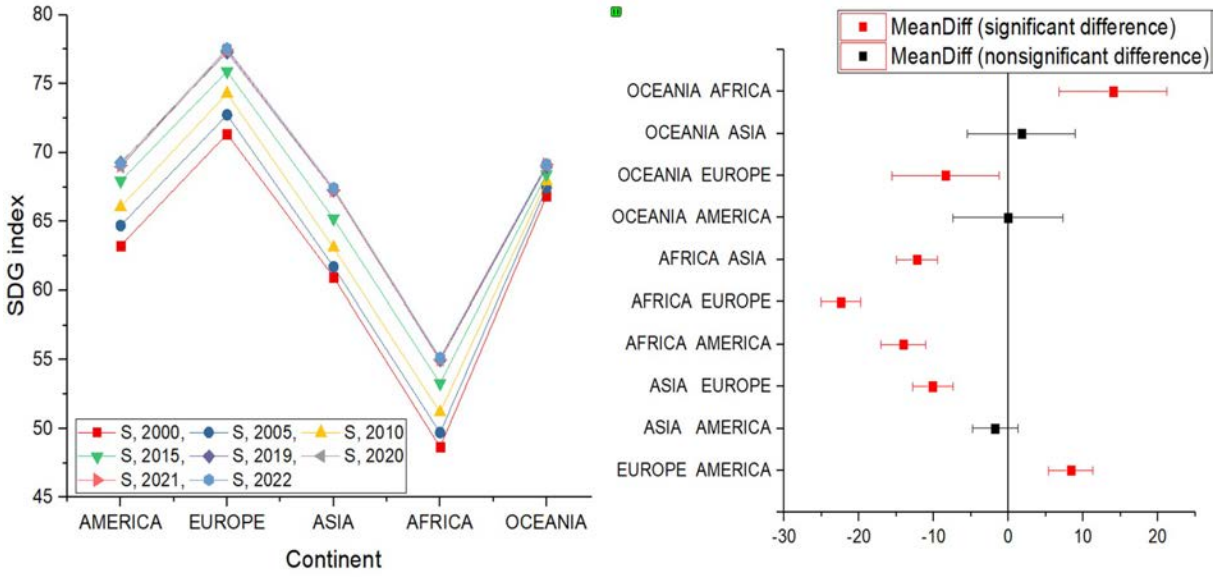

Figure 1: *Evolution of sustainable development indicator a) years 2000, 2005, 2010, 2015, 2019, 2020, 2021 and 2022, b) Representation of the minimum significant differences when comparing the behavior of the percentage index between continents.*

SDG Index score by country for each continent

The above behavior of each continent is due to the countries that comprise it. Figure 2 shows heat maps, which represent the evolution of the SDG index in the years studied (2000-2022) by country in each continent: a) Europe, b) Asia, c) Oceania, d) America, and e) Africa. In the European continent (Figure 2a), the countries that reached the highest SDG index values are Finland (86.51), Sweden (85.19), and Denmark (85.63). It is worth mentioning that, in the case of Sweden, since the beginning of the millennium, it had the highest SDG index value (83.62) among all European countries and the world. In many countries from the year 2000-2019, there are higher changes of color intensity in the thermal map, associated to the evolution presented in the SDG indicator. It coincides that in the Covid-19 period there was more homogeneity of color in the map of countries. In general, the behavior of the SDG index of the countries is observed, which was with a) slight changes b) no changes and c) others regressed. The highest percentage increase, according to the countries covered in this analysis in the SDG index (from 2000-2022) were Estonia (14.2%) and Uzbekistan (14.9%)

In Asia (Figure 2b), The countries of Japan and Korea are with the highest SDG index values with respect to the other countries. It is possible to observe that since the beginning of the millennium (2000), both countries had the highest index values. Although Cambodia (30%) and Nepal (26%) are the countries that reached the highest percentage increase when comparing the SDG index in 2000 and 2022.

New Zealand is the Oceania country with the highest SDG index value (78.3) and the highest value since 2000 (76.62). In contrast, Papua New Guinea (PNG) has the lowest SDG index values and Australia has the highest increase (6.22%) when comparing its value in 2000 and 2022 (Figure 2c).

In the Americas (Figure 2d), the SDG index value ranges from 47.40-77.90, with the most stable country with the highest SDG index in 2022 being Canada (77.73); this country since the beginning of the millennium (2000) in this continent was the best rated (74.55).

However, the countries with the higher index increase from 2000 to 2022 are the Dominican Republic (15.1%) and Ecuador (15%). Although at the time of Covid-19 there was no increase, on the contrary, in the case of Ecuador it was rated with a slight decrease in this index during that period (0.3%). It is worth noting that Venezuela decreased its index in 2019 compared to 2015, and in the pandemic period it had

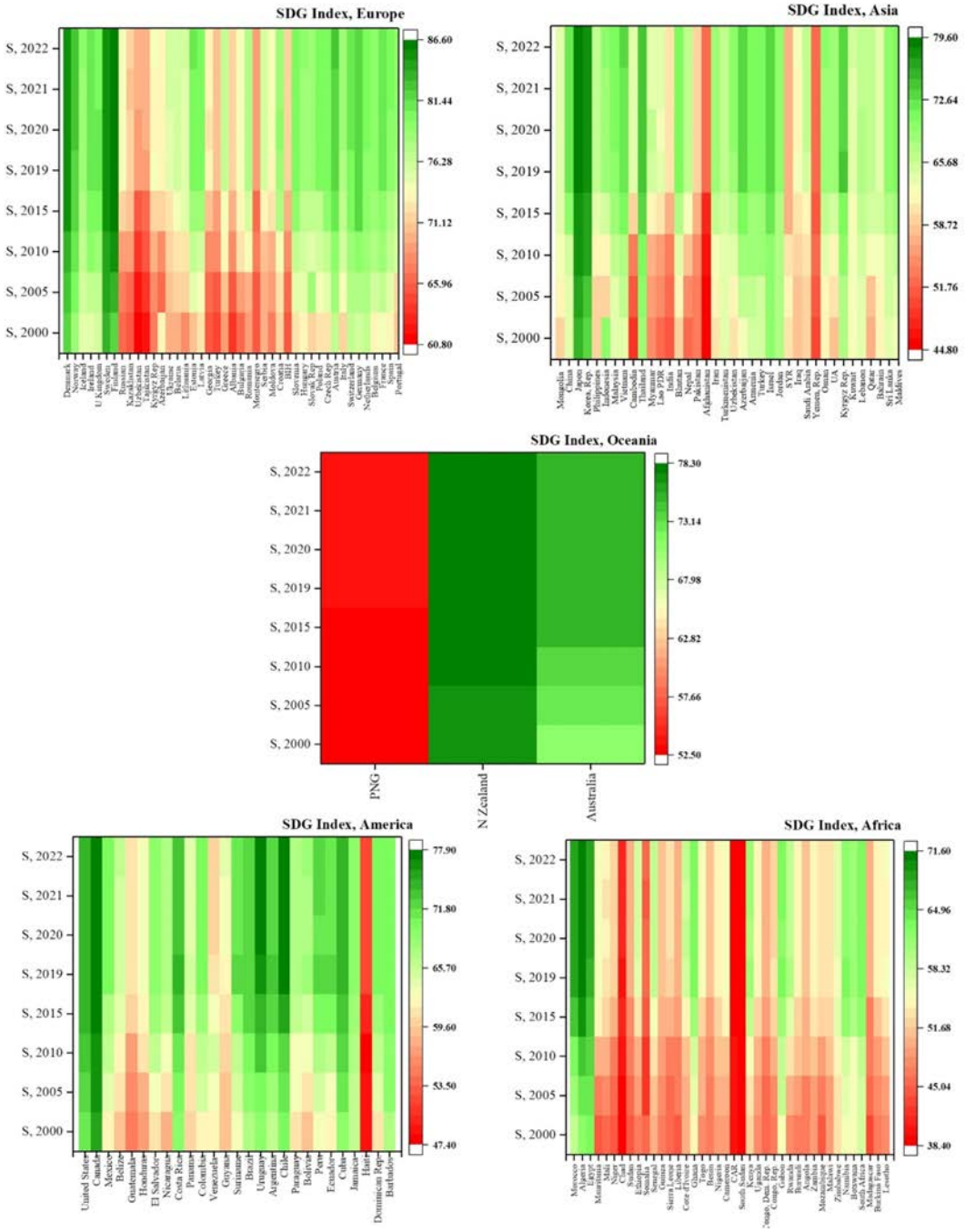

Figure 2: *Evolution of sustainable development indicator (2000-2022) by country a) Europe, b) Asia, c) Oceania, d) Americas, and e) Africa.*

another additional decrease.

Concerning the African continent (Figure 2e), the index in 2022 ranges between the values of 38.40-71.60 and of the countries considered (40), among which more than 50% are rated with an index of less than 55 percentage points. There are countries such as Somalia that have had no movement in their SDG index

rating and the Central African Republic (CAR), which even had a slight drop in the percentage of the SDG rated value (0.43). As well as South Sudan with the lowest score obtained in the SDG index since 2000 (38.61) to date in 2022 (39.05), representing an 80% below the best positioned countries in this continent Algeria (71.54) and Morocco (68.98). Although Rwanda was the country in this continent that presented the highest percentage (24.41%) increase in this index from 2000 to 2022.

It is noteworthy how the pandemic period represented an affectation to sustainable development in the world. This can be seen in the principal component analysis (Figure 3). In all Figures 3 (a), (b), (c), (d) and (e), the vectors representing the SDG index values for the years 2019-2022 are more correlated when compared to the years back (2000, 2005, 2010 and 2015). This means that they have a more similar behavior. The Asian continent is the most correlated in the vectors representing this period of years (Figure 3c). On the other hand, in the Americas (Figure 3a) there are 6 clusters (red, orange, yellow, yellow-green, yellow-green, green, and blue) of performance in the SDG index. The countries represented in red (on the right of the graph) are the countries that in this year (2022) have been evaluated with the highest SDG index scores. These include Canada, Chile, and Uruguay, followed by the United States, Costa Rica, Cuba, Brazil, and Argentina. It is possible to observe that Haiti is on the far left of the graph, contrary to those with the highest SDG index (located on the right), since its SDG index rating is the lowest in the American continent (Figure 2d).

On the European continent (Figure 3b), it is observed that in 2022 five clusters are formed, where it is observed (red symbol) that one of these clusters is formed by the countries with the highest SDG index value (Finland, Sweden, and Denmark). Moving the graph from right to left, the cluster (yellow-green symbol) is formed by the countries of Norway, United Kingdom, Austria, Germany, Holland, Ireland, and France, among others. The countries with the lowest values are located on the left in the clusters with intense and light blue color, among the countries found are Uzbekistan, Tajikistan, Montenegro, Turkey, Albania, Bosnia, and Herzegovina, etc. The angle formed between the vectors representing the years 2000 and 2005 is greater than with respect to 2005 and 2010, 2010 and 2015 and 2015 and 2020. The greater angle is related to a lower correlation, which is associated with higher growth in the SDG index in that five-year period.

For the Asian continent (Figure 3c), the angle formed between 2010 and 2015 is higher than the angle formed between the other five-year periods (2000 and 2005, 2005 and 2010, 2015 and 2020), i.e., the period of highest growth. Unlike what happened in the pandemic period, where the vectors representing the years 2019, 2020, 2021 and 2022 have an angle of almost 0° between them, this means that the behavior was almost the same in the pandemic period.

In Oceania (Figure 3d) the three countries considered have different behavior, forming three clusters. In the period 2010-2015, it is in this continent where the greatest changes in the SDG index behavior occurred. It is worth noting that the years 2020, 2021 and 2022 are closer to the vector represented by 2010 than 2015. This is associated to the fact that in Covid-19 times, there was a decrease in the evolution of the indicator.

In Africa (Figure 3e), there was a tendency to increase in the five-year period from 2015-2019, but from 2019-2022, there is a high correlation between the vectors, which could be associated with a similarity in the behavior of the SDG index. The countries with the highest index are classified by clusters (red and yellow symbol) composed by the countries of Algeria, Egypt, Morocco, South Africa, Ghana, Namibia, among others. The countries that have the lowest evaluation in the SDG indicator, form a cluster (deep blue symbol), among which are the countries that are in the lowest evaluation in the SDG indicator (red and yellow symbol). Sudan CAR, Somalia. In these graphs it is easy to visualize the countries that are in the highest growth ranges of the indicator and those that are at the bottom (right and left side of the graphs, respectively).

Finally, Figure 3f shows the countries with the best indicators for each continent. The vectors represent indicator behavior in 2019, 2020, 2021 and 2022. It is possible to observe how in the world, the countries with the highest growth are European countries and African countries at the end. The highest growth of these countries is located between 2019 and 2020. Subsequently (2020, 2021 and 2022) the correlation between the vectors increases. Therefore, their behavior is more similar, i.e. there were almost no changes.

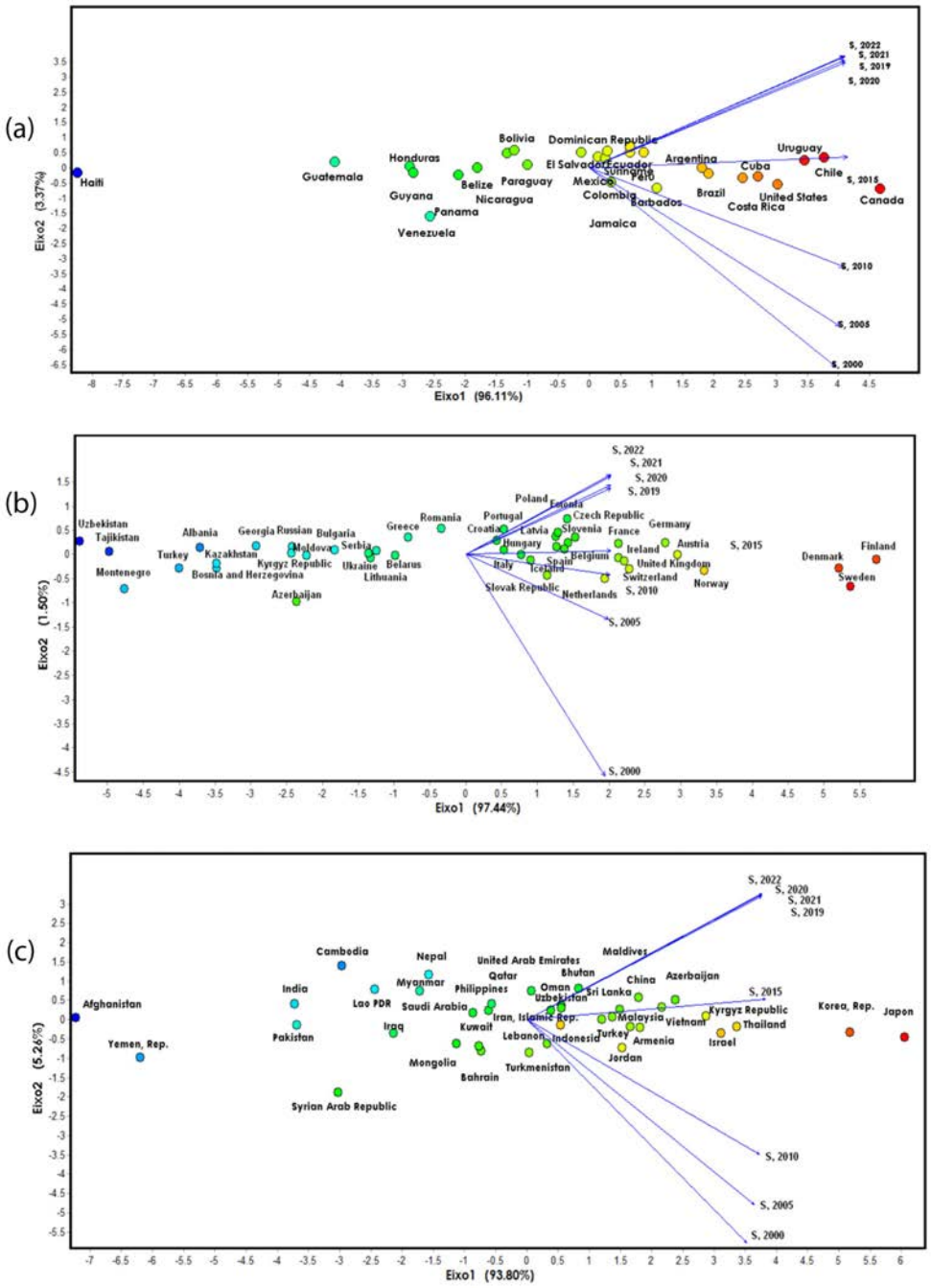

Figure 3: *(a)(b)(c): Principal component analysis of SDG index for the years 2000, 2005, 2010, 2015, 2019, 2020, 2021, 2022 in countries of the continents: a) America, b) Europe, c) Asia.*

Thus, confirming the effect on the SDGs index due to the global pandemic.

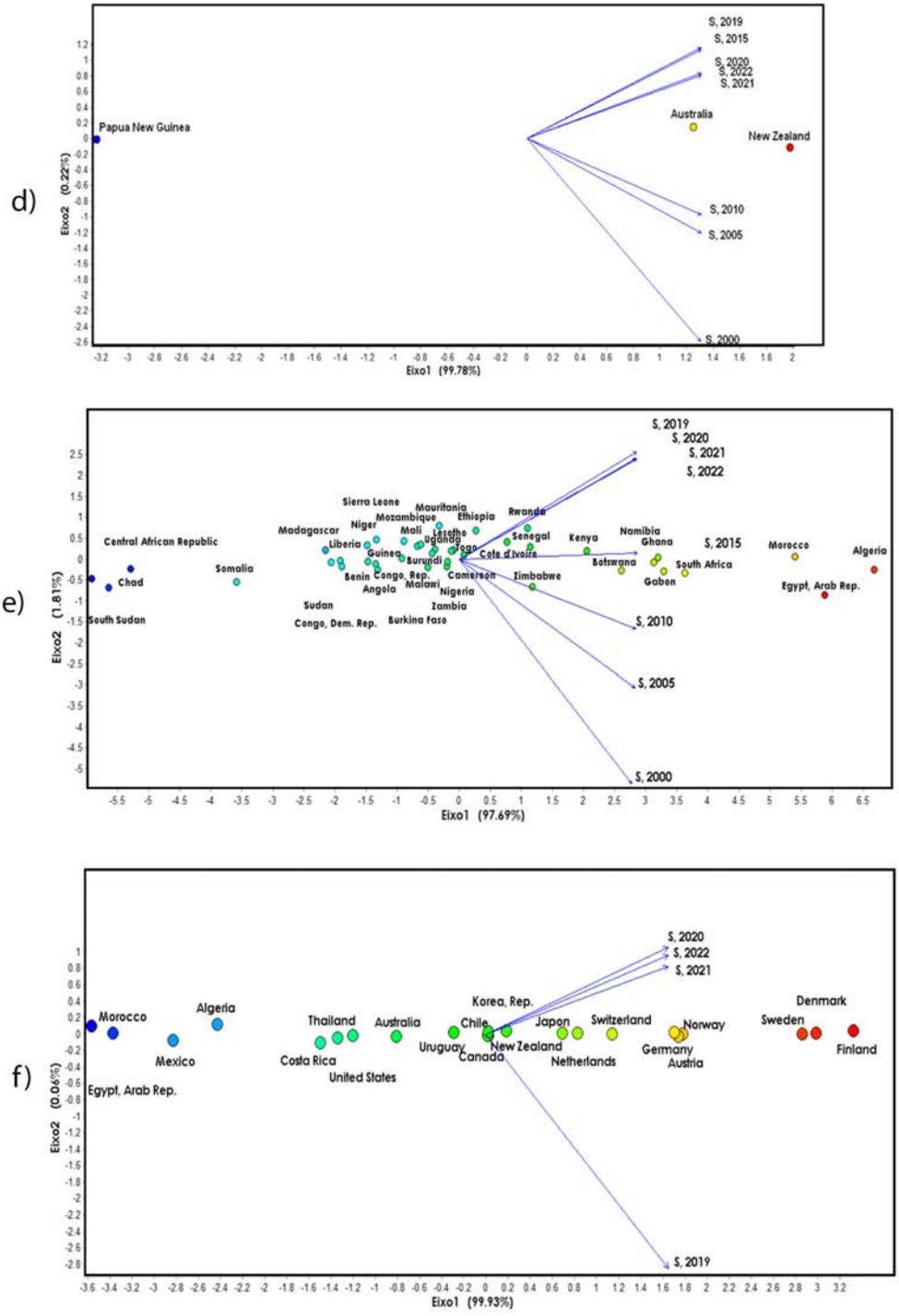

Figure 3: *(d)(e)(f): Principal component analysis of the SDG index for the years 2000, 2005, 2010, 2015, 2019, 2020, 2021, 2022 for the countries of the continents: d) Oceania, e) Africa and f) Asia Considering the countries with the highest sustainable development per continent for the years 2019, 2020, 2021 and 2022.*

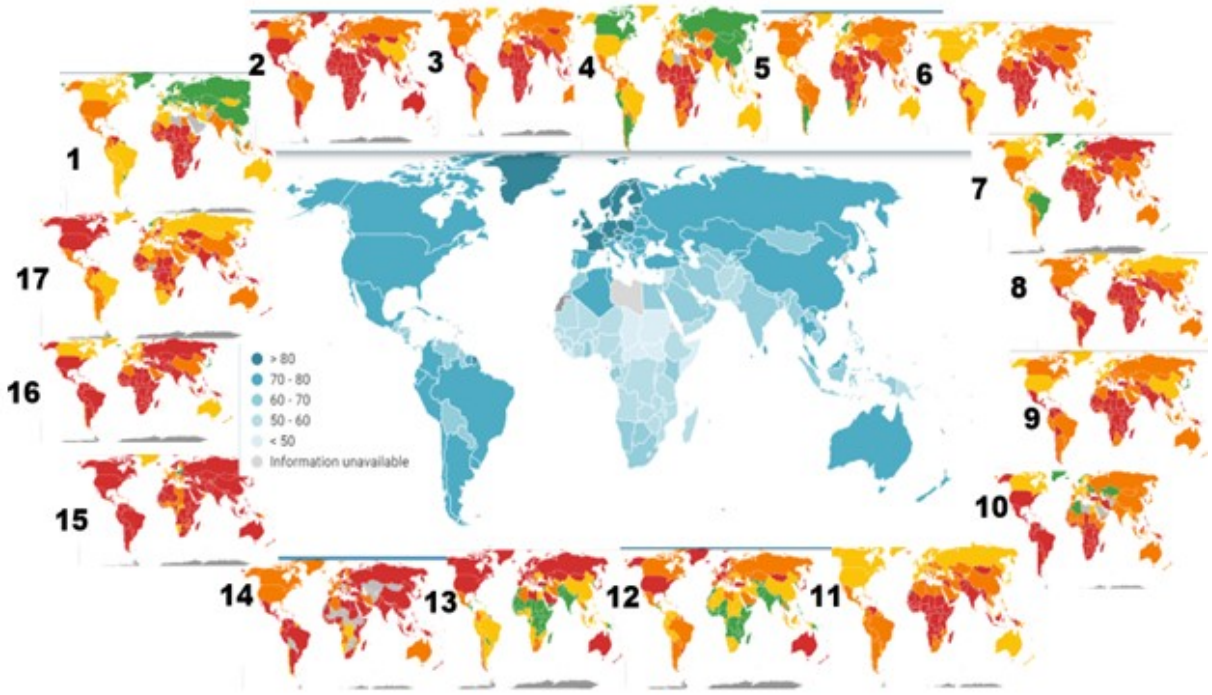

Figure 4: *integrates the global maps [24] of each of the sustainable development goals: 1). No Poverty, 2) Zero Hunger, 3) Good Health and Well-being, 4) Quality Education, 5). Gender Equality, 6) Clean Water and Sanitation, 7) Affordable and Clean Energy, 8) Decent Work and Economic Growth, 9) Industry, Innovation, and Infrastructure, 10). Reduced Inequality, 11) Sustainable Cities and Communities, 12). Responsible Consumption and Production, 13). Climate Action, 14). Life Below Water, 15) Life on Land, 16) Peace, Justice, and Strong Institutions, and 17) Partnerships. (Green region: "SDGs achieved", Yellow: "Challenges remain"; Orange: "Significant challenges remain", and cherry: "Significant challenges remain", grey: Information not available).*

Figure 4 presents the global map of the sustainable development index (2022) in the center [24]. Around the central map are located the 17 global maps that represent the current status of each of the sustainable development goals. It can be seen that the most achieved goals (green region) in the world are: 1). No Poverty, 4) Quality Education (ranked in the economic and social dimension, respectively). Other goals achieved in fewer countries were goals 7, 10, 12, and 13 (social and ecological dimension). The goals that are in the most critical situation of non-compliance at the global level are SDGs 2 (economic dimension), 15 (environmental dimension) and 16 (social dimension). Table 1a, 1b and 1c detail the status of each of the goals in the world that have been classified as a) Best-performing or challenges remain and b) Major Challenges remain and "Significant challenges remain".

It is possible to observe that in the objectives related to the economic dimension (1, 2, 3, 8 and 9) there are objectives where no country in the world has achieved them (2, 3 and 8). It is worth mentioning that objective 9 is only achieved by Japan. In general, the African continent is the one that presents the most critical situation in its fulfillment of objectives (Table 1a). On the other hand, Table 1b shows the status of the objectives that address the social dimension (4, 5, 10, 11, 16 and 17). Only objective 11 has not been met by any country. There are goals that have been achieved by countries in Asia and Europe, Goal 10 (Japan), Goal 16 (Japan and Iceland) and Goal 17 (Norway). The continents that still present major challenges are Africa, America, and Asia to a much greater proportion.

Table 1a. Status of SDGs compliance: Economic dimension, according to sustainable development maps based on the global SDGs index according to global maps by goal [24].

Goal	Best- performing or challenges remain	Major Challenges remain and "Significant challenges remain"
1 End of poverty	The continent with the best results is Europe, followed by Asia, America, and Oceania. European countries and China have achieved the SDG target (green region in Figure 4). Countries in Africa (Morocco, Algeria, and Tunisia) have "challenges remaining" – (region highlighted in yellow).	The African continent is the one whose countries present the greatest challenges (major challenges remain - shown in cherry color) such as Senegal, Guinea, Sierra Leone, Cote d'Ivoire, Benin, Nigeria, Chad, Sudan, South Sudan, Central African Republic, Congo, Angola, Zambia, Mozambique, Uganda, Rwanda, Nigeria, Tanzania, Kenya, Madagascar, etc.)
2 Zero Hunger	**No country has** achieved the goal	There are still major challenges to be covered throughout the world. China presents evaluation as "Challenges remain" (Fig. 4-region amarilla). The other countries present both "Significant challenges remain" and "Major challenges remain". As is well known, the most critical continent is Africa, where almost all the countries have "Major challenges remain" (countries in cherry color in Figure 4).
3 Good Health and Well-being	**None of the world's countries** considers that it has achieved this goal. There are several countries that present "Challenges remain", i.e., in the scale of the report at a level to cover the goal. These countries are for example Japan, New Zealand, Norway, Denmark, United Kingdom, Iceland, Ireland, Spain, Portugal, Greece.	On the African continent, Algeria has "Significant challenges remain". All other countries are still facing "Major challenges remain" (colored cherry on the map). On the American continente: Mexico, Guatemala, Honduras, Nicaragua, Colombia, Venezuela, Guyana, Suriname, Ecuador, Peru, Bolivia and Paraguay. In Asia: Turkey, Jordan, Iraq, Iran, Afghanistan, Pakistan, India, Myanmar, Lao PDR, Vietnam, Cambodia, etc., among others. In Oceania with "Major challenges remain" is Papua News Guinea. In European countries (continent with better compliance) most of them are in a state of "Significant challenges remain".
8 Decent Work and Economic Growth	**None of the world's countries** considers that it has achieved this goal, although the best evaluated continent has been Europe.	The most critical situation is in Africa, followed by the Americas.
9 Industry, Innovation, and Infrastructure	**Japan** is the only country that has reached the goal (green color on the map). Although there are other countries in America (United States) and Europe (Iceland, Ireland, United Kingdom, Germany, Netherlands, France, Austria, Norway, Sweden, Finland) and even Asia (China and Korea) that are on their way to compliance since they are evaluated at the "Challenges remain" level.	The most critical situation is in Africa (more than 50% of the countries of the continent) followed by the Americas (Mexico, Honduras, Guatemala, Nicaragua, Costa Rica, Colombia, Venezuela, Guyana, Bolivia, Chile), these are rated as "Major challenges remain". Countries in Asia (India, Afghanistan, Pakistan, Myanmar, Cambodia) and Oceania (Papua New Guinea) share the same rating.

Table 1b. Status of SDGs compliance: Economic dimension, according to sustainable development maps based on the global SDGs index according to global maps by goal [24].

Objetive	Best- performing or challenges remain	Major Challenges remain and "Significant challenges remain"
4 Quality Education	There are several countries with "SDG achieved", in the European continents (**Finland, Estonia, Russian Federation, Belarus, Serbia, Croatia**), the Americas (Canada, Peru, Argentina, Uruguay), and Asia (China, **Japan**, Korea, Vietnam, Mongolia, Sri Lanka, United Arab Emirates).	It should be noted that more than 50% of the countries in Africa are in "Major challenges remain" status
5 Gender Equality	The countries with an assessment as "SDG achieved" are **Argentina** (Americas), **Norway** (Europe), **Sweden** (Europe), **Namibia** (Africa) and **New Zealand** (Oceania).	The major challenges are found in countries on the African and Asian continents.
10 Reduced Inequality	It is the Asian country: **Japan,** the country that has reached the goal. However, countries such as Malaysia, China and Korea in Asia are also evolving towards this goal. On the European continent, Iceland, Ireland, Norway, Sweden, United Kingdom, France, Germany, Netherlands, and Denmark are evolving. The United States is also improving in the Americas.	Countries on the American continent, followed by countries in Africa, are the "Major challenges remain".
11 Sustainable Cities and Communities	**None country has reached the goal.** However, Countries have been evaluated with "Challenges remain": Americas (United States, Canada, Uruguay), Oceania (Australia and New Zealand), Asia (Japan, Korea, Malaysia), and Europe (Finland, Sweden, Norway, Denmark, United Kingdom, Ireland, Iceland, Switzerland, Spain, Portugal, France, Netherlands, Austria, Czech Republic, Hungary, Romania, Lithuania, Estonia, etc).	The African continent has major challenges to be covered in more than 50% of the countries that make up the continent.
16 Peace, Justice, and Strong Institutions	The countries in the world that have met this goal: in Asia **(Japan)** and in Europe (**Iceland**).	Other countries that have advanced the fulfillment of this objective qualified as "Challenges remain" are: in America (Canada), in Oceania (Australia), in Europe (Portugal, Spain, Ireland, Italy, Germany, Belgium, Austria, Czech Republic, Poland, Greece, Slovenia, Latvia, Finland, Norway, Sweden, Georgia).
17 Partnerships	"SDG achieved" for **Norway** (region of the map in green).	Countries with major challenges to solve are in the Americas (United States, Canada, Venezuela), in Europe (United Kingdom, Ireland, Netherlands, Switzerland, Austria, Czech Republic, Poland, Latvia), in Asia (Japan, Korea, Myanmar, India, Afghanistan, Indonesia), in Oceania (New Zealand and Papua New Guinea) and in Africa (Mauritania, Mali, Guinea, Ivory Coast, Liberia, Chad, Sudan, Cameroon, Central African Republic, South Sudan, Somalia, Madagascar, Zimbabwe, Congo, Gabon).

Table 1c. Status of SDGs compliance: Economic dimension, according to sustainable development maps based on the global SDGs index according to global maps by goal [24].

Objetive	Best- performing	Major Challenges remain and "Significant challenges remain"
6 Clean Water and Sanitation	**None country** has achieved the goal.	"Major challenges remain" are in the Americas (Mexico, Nicaragua, Colombia, Bolivia), Africa (all countries except Morocco, Algeria, Egypt, Botswana, and South Africa which have "Significant challenges remain") and Asia (Mongolia, Cambodia, Myanmar, India, Pakistan, Afghanistan, Iran, Saudi Arabia, Yemen, Oman, etc.).
7 Affordable and Clean Energy	**"SDG achieved"** in South America (Brazil, Uruguay, Costa Rica) and Europe (Denmark, Finland, Norway, Portugal, Switzerland, Austria, Georgia, Iceland) and Oceania (New Zealand).	In Africa only Egypt, Gabon, Tunisia, and Ghana have "Significant challenges remain", all the others have "Major challenges remain". In Europe, countries such as Poland, Belarus, Russian Federation also have "Major challenges remain". In Asia, we have Kazakhstan, Uzbekistan, Turkmenistan, Mongolia, Cambodia, Myanmar among others.
12 Responsible Consumption and Production	**"SDG achieved"** in Americas (Guatemala and Honduras), Oceania (Papua New Guinea), Asia (Philippines, Cambodia, Korea, Lao PDR, Myanmar, Bangladesh, India, Nepal, Pakistan, Afghanistan, Uzbekistan, Yemen, etc), Africa (Madagascar, Mozambique, Zimbabwe, Zambia, Congo, Angola, Tanzania, Kenya, etc).	The countries were assessed as "still facing major challenges": in the Americas (United States), in Oceania (Australia and New Zealand), in Asia (Japan, Mongolia, Turkey), in Europe (Portugal, France, Germany, Netherlands, Austria, Sweden, Norway, Switzerland, Ireland, Greece).
13 Climate action	**"SDG achieved"** in America (Cuba, Guatemala, Honduras, Nicaragua, Bolivia), in Oceania (Papua New Guinea), in Asia (Cambodia, Korea, India, Nepal, Pakistan, Afghanistan, Yemen, Syrian Arab Republic, etc.) in Africa (Morocco, Mauritania, Senegal, Mali, etc.).	Countries in North America and Europe that still have major challenges to meet, are evaluated with" Major challenges remain"
14 Life below water	**None country** has achieved the goal. Only four countries worldwide have been assessed as on track to meet the "Challenges remain" objective Chile, Suriname, Namibia, and Congo.	Most countries in the world from all continents have an assessment as "Major challenges remain".
15 Life On Land	**"SDG achieved"** by Poland, Lithuania, and Estonia.	In the Americas and Asia, almost all countries are evaluated with "Major challenges remain" and fewer countries with "Significant challenges remain". Africa is in the same situation with "Major challenges remain" and with "Significant challenges remain". Objective 15 is the goal that needs the most work in the world.

Regarding the fulfillment of objectives in the environmental dimension (6, 7, 12, 13, 14 and 15), the objectives achieved by some countries are 7, 12, 13 and 15. Objectives 6 and 14 have not been met by any country. In this dimension (Table 1c), the fulfillment of objective 12 (responsible consumption) in the Americas (EU) presents major challenges. In relation to goal 13 (Climate action), the countries facing the most challenges are in the Americas (USA, Canada, and Chile), although many European countries also present major challenges.

Thus, there are major challenges and challenges for a sustainable world. Further evolution is needed to achieve global sustainability. Although there are some specific objectives covered in some countries, there are still great challenges in the world to be covered. These challenges are diverse according to continent, country, culture, economic level, education, etc. The small improvement (9-13%) that has been achieved in the last 22 years (mainly before the Covid-19 period) is not enough.

In this sense it is required to integrate systemically, to establish strategies for evaluation, monitoring and feedback, for the design and redesign of international policy, governments, industry, corporate. In general, in the different stakeholders of the system called humanity, with their respective actors of the problem, which must play an active, permanent, and evolving role. Thus, the role of leaders (at home, in schools, in educational institutions, in the media, in government, in international associations, in radio, TV, digital networks, press, art in its various manifestations, influencers, etc.) will be important to permeate the information to sensitize people at different holistic levels, at the corporate, community and individual levels, etc.; to adopt the changes that are so necessary (Figure 5). For this, they must also be sensitized and awaken awareness, which will require a new training of the leaders of the world (current and new) in their various holistic dimensions and roles, to help stop the destructive processes of humanity and its habitat. The formation received in informal and formal education will be determinant in the current and coming years. Education could be the central axis to achieve awareness of 1) The serious problems we face and what is projected if we do not act, 2) International agreements that have existed in the last 50 years and those that will be added, 3) Actions and technologies to be used according to what has been generated and will continue to be generated in the scientific community.

Basarab (1996) mentioned that transdisciplinary culture is impossible without a new type of education that takes into account "all" dimensions of the human being, including the spiritual dimension (Basarab, 1996) [29]. The world problem is partly a problem of awareness in humanity: among world leaders and society. They could define a shared vision as recommended by Meadows (2001) [30] to achieve the survival of the human species. Peter Senge [31] refers to the shared vision as uniting people around a common identity and aspiration; but it is not an idea, but rather a force inspired by an idea that will motivate the members of the organization to act. In this case the organization would be humanity and we would all have to develop a will, a driving force inspired by the idea of achieving a sustainable world.

Then, the transdisciplinary culture could be the methodology that supports the path towards sustainability, since it touches the subject that investigates and society in a constant process of self-investigation and self-transformation, which would lead to conscious and sustainable evolutionary attitudes. Therefore, one of the great challenges in education will be that trainers learn to transform themselves and teach students to transform themselves. In this way the transdisciplinary methodology involving spiritual, religious, or cultural development [32,33], could cultivate attitudes that lead to the way to be sustainable through Self-investigation - Self-transformation Observation, Ethics, Reflections, Transformation, Awareness, Empathy, Openness, Tolerance, Rigor, Dialogue, Collaboration, Integration, Resilience, Patience, Prudence, Shared vision, Integration, Moderation, among others [32,41]. In closing we would like to recall what Jan Forrester said more than 50 years ago:

> "A global equilibrium is conceptually possible. The actions that would be necessary for it are not easy to accept. It will probably take more pressure on humanity from the environment before such issues are taken with sufficient concern and seriousness. However, by then the time available for action will be even shorter (Forrester, 1971, see Rodriguez, 2011)." [23].

Figure 5: *Transdisciplinarity for sustainability Transdisciplinary attitudes based on what is mentioned by some authors [32-40]*

If we recall Rapetto's 1986 definition of sustainable development which states that it is: "a development strategy that manages all assets, natural resources, and human resources, as well as financial and physical assets, for increasing long-term wealth, and well-being" (Rapetto (1986), cited in Touson (2001) [43]. Then, international politics and governments in their nations still have great challenges to face by assuming

orientations in adherence to the global warming in the planetary situation due to human actions.

I tried to change the world and I couldn't

I change myself

and change the world (**Mahatma Gandhi**)

4 Conclusions

The continents (American, European, Asian, African and Oceania) have had the highest growth of the SDG indicator in the period 2000-2019 (pre-pandemic period), with slight changes during the 20020-2022 pandemic. The continent with the highest growth (2000-2022) in the indicator is Africa (13.31%), although it has the lowest average indicator value compared to the other continents. The pandemic had an impact on the sustainable development index.

There are goals for each dimension of sustainability that have not yet been achieved by any country in the five continents: 1) Environmental dimension: 14 Life below water, 6 Clean Water and Sanitation; 2) Social Dimension: 11 Sustainable Cities and Communities, and 3) Economic dimension: 8 Decent Work and Economic Growth, 3 Good Health and Well-being y 2) 2 Zero Hunger.

The countries with the highest SDGs in the last 22 years in each continent are: European (Finland, Denmark, Sweden, Norway), American (Canada, Chile, and Uruguay), Asian (Japan and Korea), Oceania (New Zealand) and African (Algeria, Egypt Arab Rep). The countries with the lowest index values per continent are European (Uzbekistan, Tajikistan, Montenegro, Turkey, Albania), American (Haiti, Guatemala, Honduras, Guyana, Venezuela, Panama), Asian (Afghanistan, Yemen, Pakistan, India), Oceania (Papua New Guinea) and African (South Sudan, Chad, Central African Republic, Somalia).

The role of formal and informal education will be relevant in the coming years. Transdisciplinarity could be a methodology that would allow us to move towards sustainable development in humanity, to the extent that we work in different dimensions and with different leaders, from politicians, government leaders, businessmen, representatives of civil society, researchers, teachers, etc.

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