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# Territorial Development at the Crossroads of Attractiveness and Sustainability

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**Abstract**

An abundant literature in spatial planning, economic geography and regional science has focused on territorial attractiveness. However, most literature does not sufficiently integrate recent research challenges induced by sustainable development. The latter issue is likely to modify profoundly the locational determinants of economic activities and the mechanisms that explain the ability of territories to attract economic activities. Consequently, a novel approach articulating the necessity of integrating the concept of sustainable development and territorial attractiveness is pertinent. The purpose of this study is to show to what extent an evidence-based analysis of sustainable development goals affects the classification of countries according to their level of development and their potential to move to a higher ranking of their performance. On the basis of panel data on 52 countries, monitored over the last ten years, and through the explicit consideration of "proxy" variables of sustainability, attractiveness, and economic growth associated with measurable indicators, the paper seeks to assess the main basic trends, to develop a typology according to the main new strategic orientation, and to analyse rank order changes in different homogeneous groups of countries. The results confirm the idea of a general two-dimensional and dichotomic trend towards (or against) sustainability and attractiveness and employment prospects. Our study confirms the widening divide between countries in terms of their socio-economic and environmental policies.

**Keywords:** attractiveness, clustering, development, sustainability, panel, territorial

## 1. Introduction

Enhancing the attractiveness of a territory is a major policy issue and a key objective of successful territorial strategies deployed by public and private actors (Noisette and Valérugo, 2010). Attractiveness is considered an indicator of territorial performance (Keramidas, 2012) and an important goal to reach prominent position on the political agenda (Newman and Thornley, 2005). Over the past decades, an abundant literature, ranging from pure theory to empirical studies, has focused on identifying the determinants of the regional attractiveness for firm locations, as well as the mechanisms that explain the ability of territories to attract new activities.

However, this literature does usually not take into account far-reaching recent changes brought about by the world-wide acceptance of the notion of sustainable development. Only a few studies have looked at the link between attractiveness and sustainable development. For example, in an article on "pollution havens" (Kellenberg, 2009), the author attempts to explain the relocation of polluting industries in terms of the weakness of regulations on environmental standards. Yet, sustainable development policies are likely to profoundly modify the determinants of activity location in various countries. Policies and actions related to the natural environment and to climate conditions are the source of new regulatory and financial constraints that affect the quality of the territory and will strongly influence its locational attractiveness.

In order to be sustainable, economic agents, and in particular companies, have to internalize ideally in their economic calculation schemes the negative social and environmental externalities generated by their production behaviour, but also to implement a modification of business motives in favour of balanced socio-environmental outcomes. These considerations are not without effect on the conditions of supply and demand of companies, and hence on their choice of location.

Early seminal works on sustainability have sought to take into account the interweaving of spaces and spatial interdependences (Zuindeau 1996). Clearly, an action, a decision or a crisis in a given territory tends to result in a widening of the impact space and means trigger spillover effects on other spaces, leading to the accentuation and proliferation of these effects (Laganier et al. 2002). The issue of sustainable development and its potential for spatial expansion is largely dependent on the interdependencies between a given territory and other interconnected territories. Some authors (Nijkamp et al. 1991; 1992) admit that the achievement of effective sustainability cannot be realised at the expense of the sustainability of other territories. Indeed, it is from the spatial extent of the economic system in the face of economic, social and environmental constraints that the issue of sustainability is addressed (Zuindeau 2000). This unquestionably calls for a global (supranational or supraregional) approach (Zuindeau 1995) based on international (or interregional) cooperation, for instance by broadening the scope of conventions and agreements between countries or regions, in particular regarding developing or less developed countries. Meanwhile, many agreements and conventions have been created, resulting in various measures of aid and assistance to the most disadvantaged groups of countries. Over the years, these groups have appeared over the years under different names (e.g., Third World, underdeveloped, developing, and since 1971, also less developed countries - LDCs). These countries suffer from low prospitity (e.g. high unemployement rates, socio-economic inequality), and a very heavy environmental decay (soil and water pollution, environmental risks).

From an empirical perspective, development and growth standards defined in advance make it possible to classify countries according to their social, health, education, and employment outcomes and policies, and according to their participation in – or support for – collective actions in favour of sustainable development. It is therefore, important to consider the consequences of a rise in adopting sustainable development and the choices made by companies in terms of location and their impact on the intra- and inter-country divide. This question has not received overwhelming attention in the literature (Olszak, 2010). Research on firm location has focused on the conditions and determinants of location, but surprisingly has not sought to cross-reference these explicitly with sustainable development approaches.

The joint awareness and global appearance of environmental crises have given rise to a change in the architecture of aid to developing countries. The aim is nowadays to better integrate environmental approaches in development policy and to enable governments in the developing world to mobilise all forces. For example, the Brazilian government is committed to containing the destruction of the Amazon rainforest, and China has become aware of the social and economic costs of massive deforestation and has recently taken steps to launch a rigorous reforestation programme However, despite the urgency of the situation, this mobilisation is far from being systemic, generalised and global. It is therefore interesting to examine if the emerging consensus on environmental and social priorities translates into new approaches to development. It should be noted that in the present study attractiveness and sustainability are analysed at a macro (national) level. Clearly, a more disaggregated geographical scale level might be appropriate, but this is hampered by the lack of availability of reliable data.

Against the above background, the research question in our study is: How can economic, social and environmental sustainability be a lever for the territorial attractiveness strategies of developed, developing, and less developed countries? And to what extent does the consideration of these approaches impact the performance classification of these countries in one group or another and their potential for intra- and inter-group change? If this is not the case, are global policies needed, to make sustainable development part of a global approach and thus mitigate antagonisms, divergences, and gaps between groups of countries?

On the basis of a panel of 52 countries (see Appendix), monitored over the last ten years with reference to "proxy" variables of sustainability, attractiveness, and growth associated with quantitative indicators, our study seeks to evaluate the main trends, in order to design a typology according to the main policy orientations, and to analyse changes in different homogeneous groups of countries. The results from our analysis confirm the idea of a general, two-dimensional dichotomy towards (or against) sustainability and attractiveness, and employment (and unemployment), and articulates the growing gap between different countries in terms of social policies regarding health, education and employment.

The remaining part of the paper is organised as follows: Section 2 reviews the relationship between territorial attractiveness and sustainable development. Next, Section 3 describes the indicators and data used. The fourth section presents the statistical results of the empirical exploration, while Section 5 offers the results of an econometric longitudinal modelling exercise. Section 6 provides concluding results.

## 2. Attractiveness and Sustainability: Theoretical Basis

The popularisation of the Rio Summit and the Paris agreements, the global unprecedented awareness of the degradation of the natural environment, and the depletion of non-renewable resources world-wild have made

sustainable development a ubiquitous topic in political and academic debates. The Rio summit took the notion of sustainable development a step further by connecting environment with economic growth, rather than putting them against each other. This makes it necessary to revisit the issue of territorial attractiveness in the light of the sustainability principles. Such an investigation may prove interesting, since sustainable development policies are likely to have a strong impact on the determinants of firm location and territorial attractiveness. Local decision makers play a central role in the implementation of policies dedicated to sustainable development. It is up to them to build the territories of tomorrow, and to project the region into the future with regard to its economic, social and environmental issues (Danneels 2016). Their decisions in favour of the natural environment and affecting the quality of the territories lead clearly to actions that are likely to profoundly modify the key factors of attractiveness (Olszak 2010).

Defined essentially as "the capacity of a territory to offer actors the conditions that convince them to locate their project in one territory rather than another" (Hatem 2004), territorial attractiveness finds its essence in the seminal work of Krugman (1991), known as the New Geographic Economy (NEG). This approach seeks to identify inter alia the endogenous determinants of company location and the volume of FDI received by a country. It takes for granted the persistence of the phenomena of spatial concentration of firms and center-periphery equilibria. The NEG explains that the location of economic activities depends on both centripetal and centrifugal forces. The former favors concentration effects and induces a concentration of physical capital towards existing centres. They arise from increasing returns to scale and urbanisation advantages related to access to information, financing, and all factor effects that will later be referred to as spatial "externalities" (Zimmermann 2008). In contrast, the latter case, due to strong competition in goods and labour markets, may lead to a spatial dispersion of economic activities. An extreme case is of course the existence of repulsion factors, such as political instability, corruption or wars. This suggests the need for a theoretical explanation of agglomeration phenomena: once centripetal forces prevail over centrifugal forces, there will be spatial concentrations of industrial activities. From then on, location decisions are made on the basis of a trade-off between the cost of transport (or market access), which increases as one moves away from the centre, and the cost of land, which increases as one moves closer to the centre.

Despite the relevance of NEG as a framework for understanding the location choices of firms, the evidence-based goals of sustainable development have rarely been studied in the literature. In this respect, the contribution of Cardebat and Musson (2010) is pioneering. The authors were able to estimate the effects of sustainable development on transport and logistics costs (supply conditions), on the one hand, and on the evolution of consumer preferences (demand conditions), on the other.

Sustainable development profoundly challenges the international dispersion of production processes (SIPP). Being fragmented and distributed according to the benefits granted by each territory, transport flows are continually increasing, leading to growing greenhouse gas (GHG) emissions, congestion, noise, visual pollution, etc. Other social costs are also associated with SIPP, manifested in labour market inequalities. Due to the relocation of production sites in developing countries requiring unskilled labour, the demand for labour naturally shifts to financially more rewarding tasks and skilled jobs in developed countries, thus inducing wage and social inequalities.

Being at the heart of the NEG, transport costs are regularly endogenised and constitute the main determinant of the trade-off between the Centre and the Periphery. If the expansion of international trade necessarily leads to an increase in the use of transport services and if sustainable development is synonymous with an increase in these costs, it becomes necessary to produce close to home in order to supply local demand. The implications for location choices are direct. We may expect a dispersion/regionalization of trade, reflecting a detour of distant trade flows in favor of local flows (Cardebat and Musson 2010). Hence, the recent emergence of promising new territorial forms such as short agricultural circuits and industrial ecology. The sustainable development goals make it possible to go beyond the limits of a classic short-term attractiveness based on price competitiveness so as to favour places with a sustainable attractiveness based on non-price performance criteria (Musson 2010).

Thus, since the emergence of the concept of sustainable development, developed countries, and more recently also developing countries, have begun to implement actions and policies that promote sustainable development. They are now making considerable efforts to preserve ecosystems and the natural environment. In parallel with these policies, these countries are continuing their efforts to attract FDI. We will now test empirically whether these actions and policies in favour of sustainable development are likely to improve the attractiveness of the countries simultaneously.

## 3. Data and Research Method

In order to analyse the nature of the relationship between the attractiveness of territories and sustainability, we will

employ existing indicators proposed by national and international organisations. These have set up indices to measure the degree of attractiveness and the level of sustainable development of a territory, on the scale of a country or group of countries.

*3.1 Attractiveness and Sustainability Indicators*

In an informed analysis of attractiveness and sustainability indicators, Musson (2010) points out that the rankings made on the basis of these indicators can lead to opposite results: those countries which obtain a high score in terms of sustainable development most often have a low ranking in terms of attractiveness and vice versa. Now more than ever, a link between attractiveness and sustainable development is pertinent.

In order to measure performance in terms of national economic attractiveness, international organisations most often use FDI. They list countries according to the FDI they have attracted and their size. This index provides information on FDI attraction performance, but does not provide information on attractiveness criteria, which may be --most often -- purely fiscal. But in order to go beyond this approach based on a single indicator, some organisations, on the basis of a battery of indicators, are constructing a single composite indicator which captures the characteristics of the business environment of each country and makes it possible to rank countries according to the quality of the business environment offered to companies. This so-named Global Competitiveness Indicator was initiated by the International Institute for Management Development (IMD) in the 1990s and published in the framework of the World Economic Forum (WEF). Its publication has led to numerous debates around the world on the country's image and level of competitiveness.

Other indicators which measure competitiveness have followed. Following its separation from the IMD, the WEF commissioned a team from Harvard University to produce a new indicator, published annually in the Global Competitiveness Year book. However, despite their undeniable media success, ideological and methodological criticisms have been raised at these indicators (Hatem, 2004). These indicators rank countries according to the narrow perspective of competitiveness and the business environment, thus obscuring other dimensions related to human development. Consequently, the UNDP has developed a more appropriate measure for alternative development: the Human Development Index. It incorporates also the standard of living, health and education (UNDP 2009). It is a relevant indicator of the socio-economic and environmental dimensions of sustainable development (Gadrey and Jany-Catrice 2005).

In the same way that it advocates global measures, and from a perspective that considers public intervention as a factor of non-competitiveness, the Heritage Foundation has proposed a synthetic indicator that aims to measure the "degree of freedom" of different countries with respect to the interventionist nature of the state in the economy. Kane et al. (2007) define economic freedom as the total absence of government pressure or constraints on production, distribution, investment, consumption and the free movement of labour and capital. The Index of Economic Freedom is constructed on the basis of a wide array of indicators related to property rights, the fight against corruption, the weight of regulation, and employment policy. According to the Heritage Foundation (2009, 2016), it measures the level of sustainable economic growth and the level of attractiveness of countries for business.

Through the various transformations that have been undertaken since 2010, and with regard to “new indicators of wealth” (Gadrey and Jany-Catrice 2005), the aim of our research is to assess the evolution of the socioeconomic situation of the countries selected. One of the priority objectives pursued by these countries – apart from promoting investment and expanding freedoms – is to fundamentally combat inequality, promote access to employment, education and health and eradicate poverty. Applying a multi-Findicator approach helps to generate a holistic view.

Gender equality is an important part of the Sustainable Development Agenda. It says explicitly: "development will only be sustainable if it benefits women as well as men"[1]. Environmental degradation and climate change threaten the livelihoods of a significant number of families. They particularly affect girls and women in developing countries, further deepening inequalities and deepening social divides (UN, 2018). Digital technology, and in particular access to the Internet, is also on the list of priorities of the Sustainable Development Programme. It is also a means to fight against inequalities and injustice and to reduce poverty. The process of digitisation of economies and societies has become a lever for sustainable development. It allows us to anticipate and manage energy, industrial processes, logistics and transportation. Access to the Internet allows access to education and health, to exercise citizenship and to control environmental risks (Berhault 2010).

The achievement of the SDGs depends on the progress made in reducing child mortality. The extent of the latter makes it possible to assess the level of development in terms of access to health care, nutrition, education, the quality of social services and data management systems. According to the UNICEF report (2020), child mortality

[1] According to Mlambo-Ngcuka, Under-Secretary-General and Executive Director of UNU femmes (2018).

has decreased globally between 1990 and 2018. But this decline masks huge regional disparities. The least developed countries remain the regions where child mortality is most concentrated (South Asia (39%) and sub-Saharan Africa (38%)). As an illustration, mortality among children under 5 years of age is 20 times higher than that observed in developed countries. But the risk of death is highest in the first month of life[2]. In 2018, 7,000 newborns died every day. This figure also includes rich countries that have not yet managed to solve the issue of infant mortality. In countries like the United States or Kuwait, the mortality rate is 4 children per 1000. This rate is close to that in Sri Lanka or Ukraine – low income countries – where the mortality rate is 5 per 1000[3].

*3.2 Presentation of the Database*

To test our proposition on the growth-sustainability dichotomy, a panel database comprising 52 countries (Annex: Table 1A) observed from 2010 to 2018 has been developed. Several sources of information were considered for the construction of this database, owing to the non-availability of the empirical study variables in a single source. A balanced panel of 468 observations could be obtained for our study purposes. The main variables monitored are related to the concepts of attractiveness and sustainability as defined above.

Ten indicators are ultimately considered. Table 1 provides an overview of the variables retained, including their definition, their sources and their codifications. These indicators allow us to visualise the multiple dimensions of attractiveness and sustainability. This choice is justified for two reasons: on the one hand, the indicators of attractiveness and sustainability selected allow us to identify these concepts in a fairly satisfactory manner. On the other hand, they allow us to have an almost perfect representation of the pillars of sustainable development. The Human Development Index (IDH) is chosen as the endogenous variable of interest. This choice is in line with the theoretical and empirical discussion about the assignment of this indicator to sustainability or attractiveness factors or dimensions.

[2] 40% of deaths occur during the neonatal period (UNICEF, 2020)

[3] https://www.unicef.fr/dossier/mortalite-infantile

Table 1. Definition of the database variables

| Variable | Code and source | Definition | Class |
|---|---|---|---|
| Human Development Index | **HDI** (PNUD) | A composite statistical index that measures the human development rate of countries. The Human Development Index takes into account three elements: GDP per capita, life expectancy at birth, and educational attainment of individuals over the age of 17. | Sustainability |
| Income Index | **IR** (PNUD) | Average annual individual income of residents of communities in designated areas. | |
| Internet Percentage | **Int** (World Bank) | Internet access rate, defined as the percentage of households that report having Internet access. | |
| Gender Inequality Index | **Gin (**PNUD) | Composite measure for inequality in outcomes between men and women along three dimensions: health empowerment, and labour market. | |
| Education Index | **IEduc** (PNUD) | Education index calculated as the simple geometric mean of two indicators: average length of schooling and expected length of schooling. | |
| Infant Mortality Rate (per 1,000 live births) | **MIn** (World Bank) | Number of deaths of children under 1 year of age per 1000 live births. | |
| Foreign Direct Investment Net Inflow (% of GDP) | **IED** (World Bank) | Direct investment from one country to another and the export of capital to another country in order to acquire or create a business or to take an interest in it | Attractiveness |
| Index of Economic Freedom | **ILE**(The Heritage Foundation) | Based on statistics from the World Bank, the IMF and the Economist Intelligence Unit, it is composed of 10 sub-indices: freedom of enterprise, freedom of trade, tax burden, government spending, monetary stability, freedom of investment, financial deregulation, protection of private property, anti-corruption and labour liberalisation. | |
| Employment to Population Ratio (percentage of 15+) | **E15p**(World Bank) | Proportion of the labour force over 15 years of age who are employed. | Employment |
| Total Unemployment (% of population) | **ChT**(World Bank) | The percentage of people in the labour force who are unemployed. It is calculated from the Employment Survey. | |

The different views on the quantification of attractiveness and sustainability make a joint measurement rather difficult. This can be explained by the divergent objectives and purposes of the two approaches. The composition of sustainability strategies and consequently the quality of indicators to assess the evolution of territories exceeds mere attractiveness. The rest of the paper will now focus the attention on sustainability and attractiveness in 52 countries belonging to different development categories. The relevance of this approach lies in the possibility to assess trends, draw up a typology, and identify orientations towards (or against) sustainability and attractiveness.

## 4. Exploratory Study on Empirics

### *4.1 Bivariate Interrelationships among the Study Variables*

The two Figures 1 and 2 below provide an overview of the 2010 and 2018 pair maps of the study variables. The diagonal of the map corresponds to the distribution of the retained variables according to the Human Development

Index variable for all countries. The upper triangular part gives the values of the linear correlation coefficients and their degree of significance (***: 1% threshold). The lower triangular part shows the nature of the cross distribution (growth, decrease, and stability). The last column corresponds to a Box-Plot representation, relative to the three groups of countries: Developed Countries, Intermediate Countries, and Less Developed Countries.

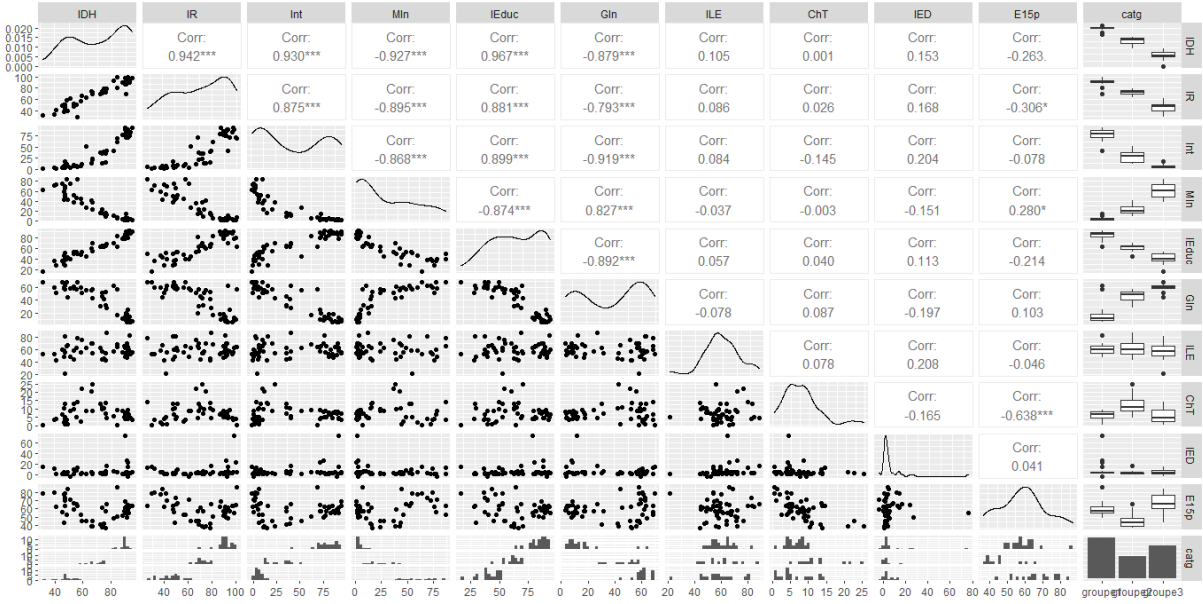


Figure 1. Map of countries (2010)

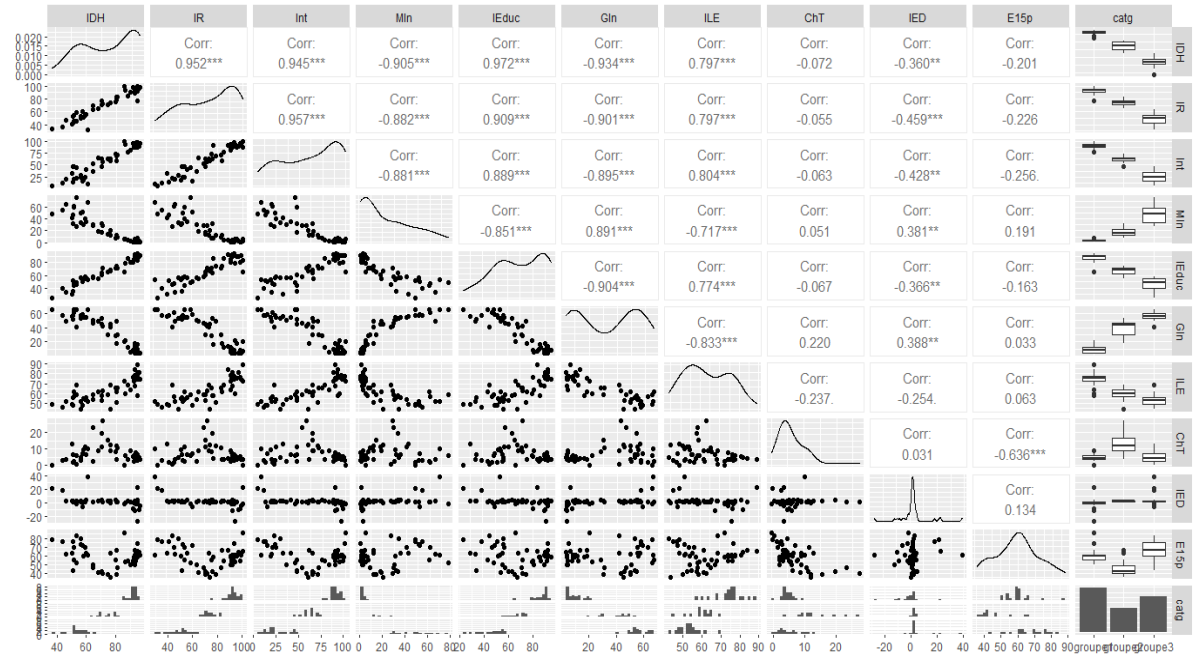


Figure 2. Map of countries (2018)

From Figures 1 and 2, clear similarities can be observed between the two bipolar Maps, both in the shape of the Human Development Index distribution curve with the other variables and in the values and signs of the correlation coefficients. The examination of the main diagonal lines leads to the conclusion that there is a priori a positive relationship between the Human Development Index variable and its standard components (IR, Int, IEduc), and a negative link with mortality (a variable that can be considered as a proxy for low life expectancy).

However, it is also noteworthy that disparities appear in the ILE, IED, FDI and Int variables. Compared with 2010, the distribution of the Internet variable shows a continuous growth in 2018, reflecting a general trend towards

digitalisation. The distribution of the ILE variable, which for the year 2010 has a strong concentration around the mean, shows a remarkable evolution in 2018. The comparison of the two associated whisker boxes shows that this evolution affects, in particular, the group of developed countries (group 1). The distribution of the FDI variable is homogeneous among the three groups in both 2010 and 2018. However, even though there is a clear shift in the value of FDI for all three groups of countries, it seems that international investments that were more concentrated in DCs in 2010 were explicitly shifting to intermediate countries (ICs). The presence of FDI in this group of MICs is, at first glance, an important signal of the attractiveness of these countries and suggests that employment prospects in these countries are beneficial as of 2010. However, we show later that this was not the case and that the IC group did not experience major changes in sustainability and employment prospects.

*4.2 Multivariate Analysis*

To highlight the multivariate interrelationships between the selected variables, we performed a principal component factor analysis. This analysis allows us to identify the main dimensions, and to assign the countries to these dimensions. This typology is confirmed by a hierarchical ascending classification.

4.2.1 Principal Component Analysis

After validation of the factorisation (KMO 0.79 in 2010 and 0.86 in 2018) and rejection of the null hypothesis in Bartlett's test, the comparison of the results between 2010 and 2018 (detailed in the Appendix) leads to the following conclusions.

The component matrices represented by Figures 3 and 4, reflect the degree of correlation of the variables with the selected dimensions, respectively for 2010 and 2018. The intensity of the colour and the size of the balls provide information on the strength of the correlation in absolute value. We will now successively discuss the findings for the years 2010 and 2018.

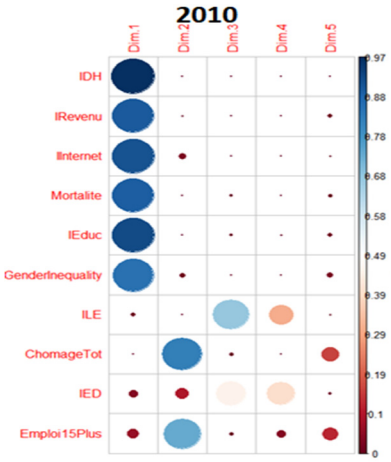


Figure 3. Component Matrix 2010

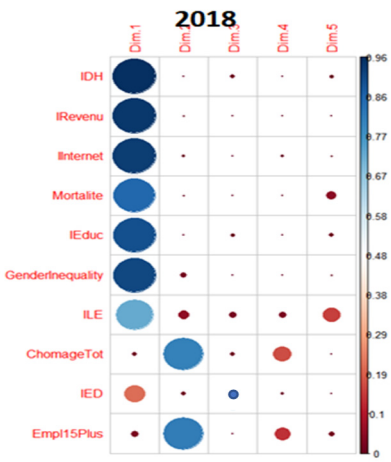


Figure 4. Component Matrix 2018

**Findings for the year 2010**

Three dimensions are identified that explain 84.29% of the total variance. The first one explains 55.59% ; its contribution is about 6 times higher than the average (eigenvalue of 5.55). It is essentially formed by the variables IEduc, IDH, Int, ILE, in positive direction, which are opposed in sign to the variables GIn (Gender Inequality) and MIn (Infant mortality rate). Given its components, this dimension is essentially a Sustainability dimension.

The second, much smaller component (17.05% of the total variance) is Employment15+ (E15p) versus Total Unemployment Rate (ChT). This dimension relates to Employment Outlook. It reflects a component of sustainable development and is a consequence of attractiveness. Indeed, sustainable development can contribute directly to social welfare (IISD, 1994). It is the source of more promising and potentially important employment prospects consistent with its goals. It implies a new vision of the future. It leads to the creation of new jobs and new activities that protect and restore the environment in the fields of research, design, production, marketing, and recycling.

A third dimension is identified that is orthogonal by construction of the PCA to the first two. Although its contribution is only 11.64%, it is still above average. It reflects in its positive direction the variables ILE and IED, which are considered in the literature to be indicators of attractiveness (Heritage Foudation, 2016; Kane et al.

(2012), making it an Attractiveness dimension.

**Findings for the year 2018**

The results of the factorisation are almost similar to those of 2010, both in terms of the validation criteria and the percentage of variance explained. However, a difference appears at the level of the dimension of the factorial space retained. In fact, in 2018, an equivalent percentage of explanation (82.07%) is achieved by only two components: Sustainability and Employment Outlook. The first main component, Sustainability, has slightly more importance (64.88% equal eigenvalue 6.49). In addition to the components that are positively correlated with it in 2010 (IEdu, IDH, Int, ILE), the ILE variable is added with a fairly high correlation coefficient (0.85%). Thus, the Index of Economic Freedom (ILE), at the base reflecting attractiveness and appearing in 2010 in a dimension orthogonal to that of Sustainability, occurs in 2018 in combination with the dimension Sustainability. This result is consistent with the Environmental Kuznets Curve (EKC) hypothesis, which postulates an inverted U-shaped relationship between economic development and environmental damage per capita. The latter increases in the early cycles of economic development, peaks, and then begins to decline when higher income levels are reached. Indeed, economic freedom is fundamental to creating an environment conducive to innovation and entrepreneurship (Nystrom 2008). It provides the means for improved economic growth (Nelson and Singh 1998; Akinci et al. 2014), opportunities for increased per capita income levels, and improvements in development in general (Stevenson 2010). Having seen their rise in standard of living, inhabitants and economic actors are becoming increasingly sensitive to environmental issue. The technology and wealth level of a nation allows for better methods of clean production (Goodwin et al. 2014) and thereby internalises the principles of sustainable development. Although the relationship between economic freedom and sustainability is, in reality, more complex, some convergence appears to be emerging, according to our results. The recent literature points at a reconciliation between the two sets of indicators, Sustainability and Attractiveness. This allows us to underline the existence of a certain compatibility between the two concepts (Désiré et al. 2012). The association of sustainability with attractiveness is apparently likely to lead to a sustainable attractiveness based on non-price performance criteria (Musson 2010), in terms of the quality of the business environment, infrastructure, the quality of the workforce, and employment prospects. However, this is only true for the DC group. We will show later that this trend will be confirmed by the analysis of panel data over the whole period.

The second component, Job Prospects, retains practically the same percentage (17.19%) and the same components. On the other hand, the FDI variable is not correlated with either of the two dimensions retained. This variable, having been strongly related to the attractiveness dimension in 2010, becomes non-discriminatory in 2018. Indeed, the empirical findings confirm the downward trend in the level of FDI in the world in this period. The United Nations Agency for Trade and Development (UNCTAD) confirms in its 2018 Annual Report that the fall in the FDI has ensured a decline of 19% or about 1,200 billion dollars. This corroborates the findings of the United Nations report (UN 2020) which states that the imperative of sustainability, combined with the rise of nationalism, has contributed to a gradual disinvestment in developing countries and a notable decline in FDI. This may result in a trend towards the homogenisation of FDI across countries, making it non-discriminatory. The results of the PCA are shown graphically in the factorial pictures below and the corresponding correlation circles for 2010 and 2018, respectively (Figures 5 and 6).

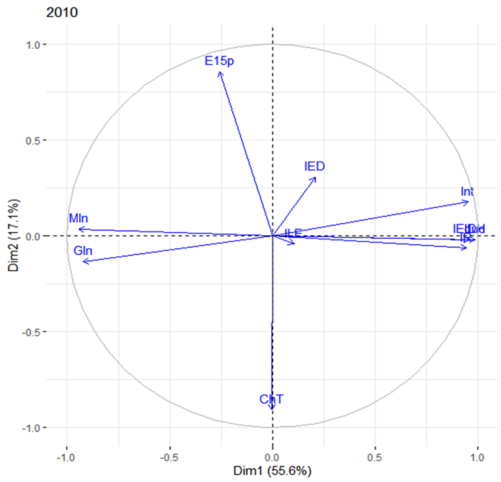


Figure 5. Factorial picture 2010

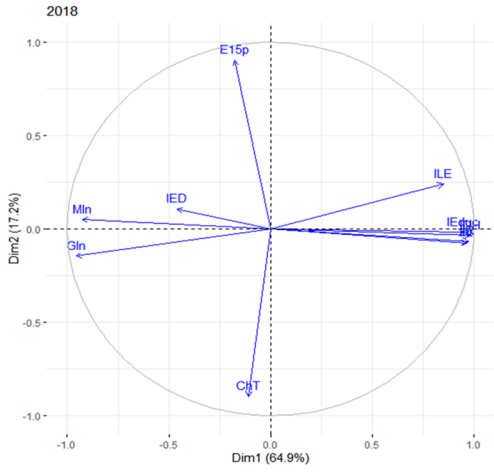


Figure 6. Factorial picture 2018

Among the two graphs, the representation of the variables on the axes is the same, except for the FDI variable. During the period 2010 and 2018, the groups of variables maintain their distributions with respect to the selected dimensions. The variables Gender Inequality and Infant Mortality appear to be negatively correlated with the Human Development Index variable in both the 2010 and 2018 factorial designs (Figures 7 and 8).

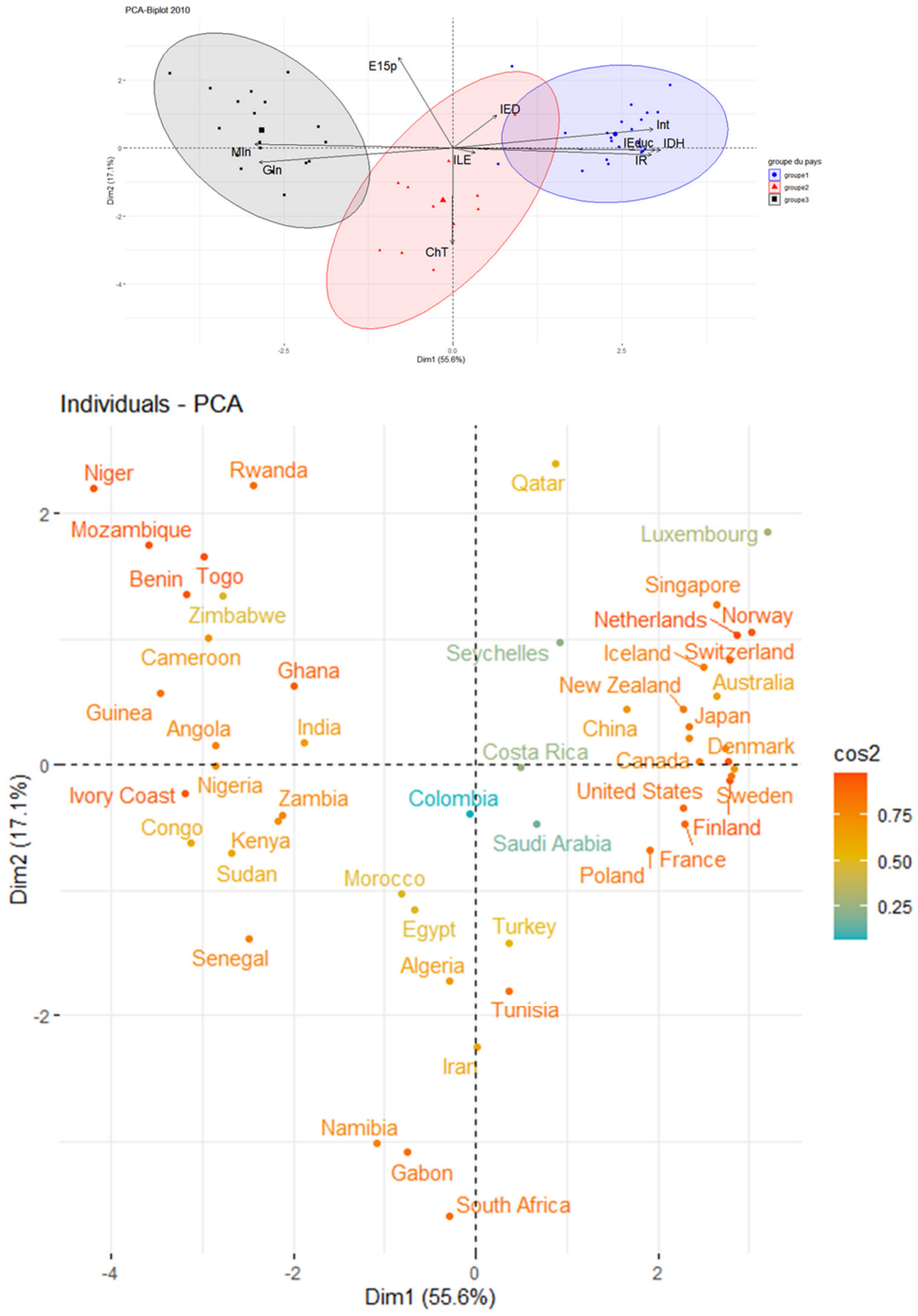


Figure 7. PCA-Biplot 2010

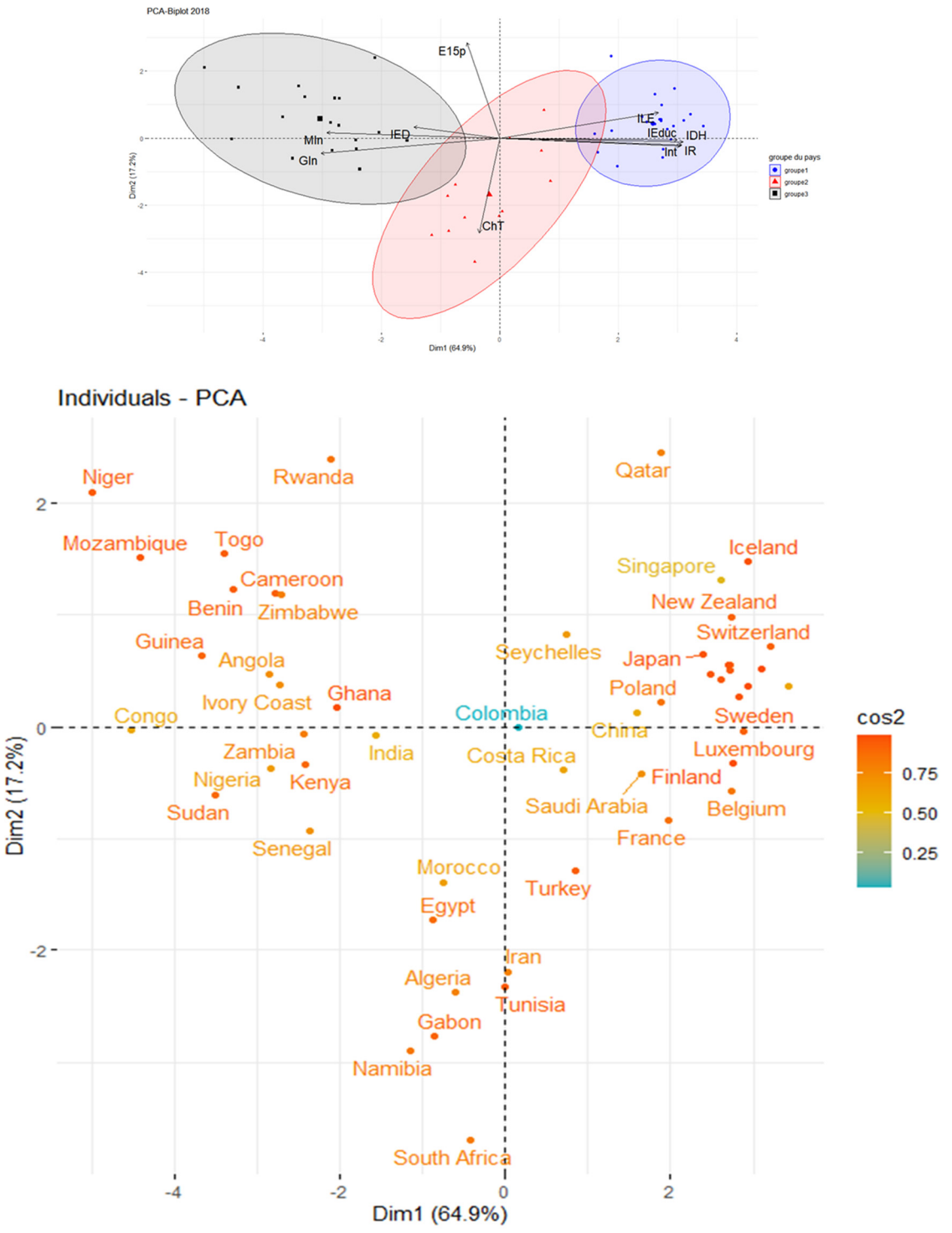


Figure 8. PCA-Biplot 2018

Figures 7 and 8 illustrate the groups of variables and provide information on the distribution of countries by group. The first Group includes countries with a high Human Development Index (HDI) (Developed Countries (DC)); Group 2 presents countries with critical unemployment (ChT) (Intermediate Countries (IC)); and finally, Group 3 concerns other countries with a low health regime (Infant Mortality ratio) accompanied by a critical level of the Gender Inequality indicator; these are the Less Developed Countries (LDC). The comparison of the two representations leads to the following conclusions: The blue ellipse, corresponding to the group of Developed Countries (DC), tends to shrink between 2010 and 2018. It reveals that these countries are becoming more and

more homogeneous, Indicating the decrease of disparity between them and an increased interdependence. These countries are increasingly moving towards sustainability.

The red ellipse, corresponding to the Intermediate Countries (IC), shows that neither the shape nor the position of the scatterplot has changed between 2010 and 2018. One can observe, however, that there are a few (very few) points that have moved towards a positive direction of the x-axis. This indicates that only some intermediate countries have made some progress in meeting sustainability goals. This progress did not allow them to migrate to the (DC) group, but it did allow them to move up in the intra-group ranking, as we will show below.

The black ellipse encompasses the LDC group. In contrast to the ellipse of the DC group, the latter shows a very apparent dilation demonstrating an ever-increasing and explicit disparity and dispersion between these countries. Even worse, the position of the observation cloud relative to the origin shows that these countries moved away from sustainability between 2010 and 2018.

4.2.2 Hierarchical Classification

**Confirmation of groups**

The highlighting of groups and the confirmation of country membership in the various groups established by the factorial analysis (Figures 7 and 8) are confirmed by the use of the Hierarchical Ascending Classification (HAC) method, for all the countries in the sample and according to the variables selected. The results of this analysis, based on Ward's criterion and the square of the Euclidean distance, are presented below (Figures 9 to 12).

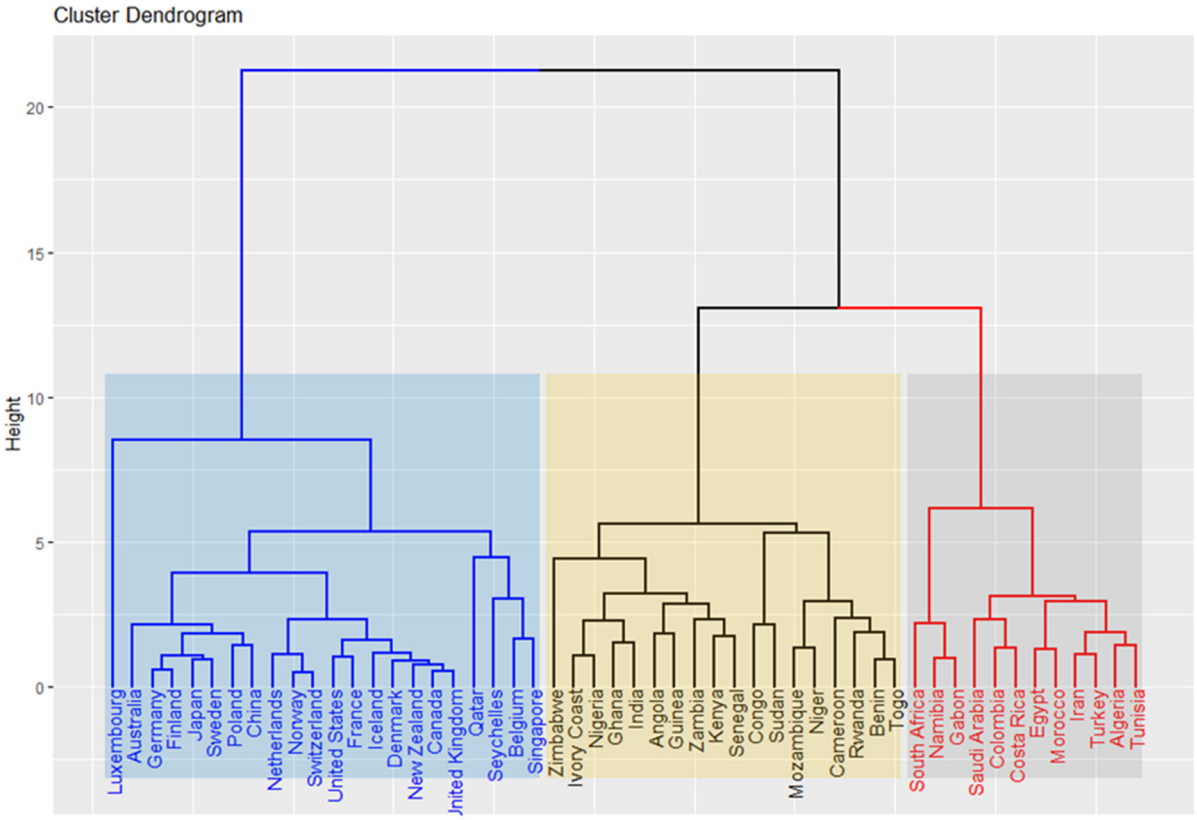


Figure 9. Countries classification 2010

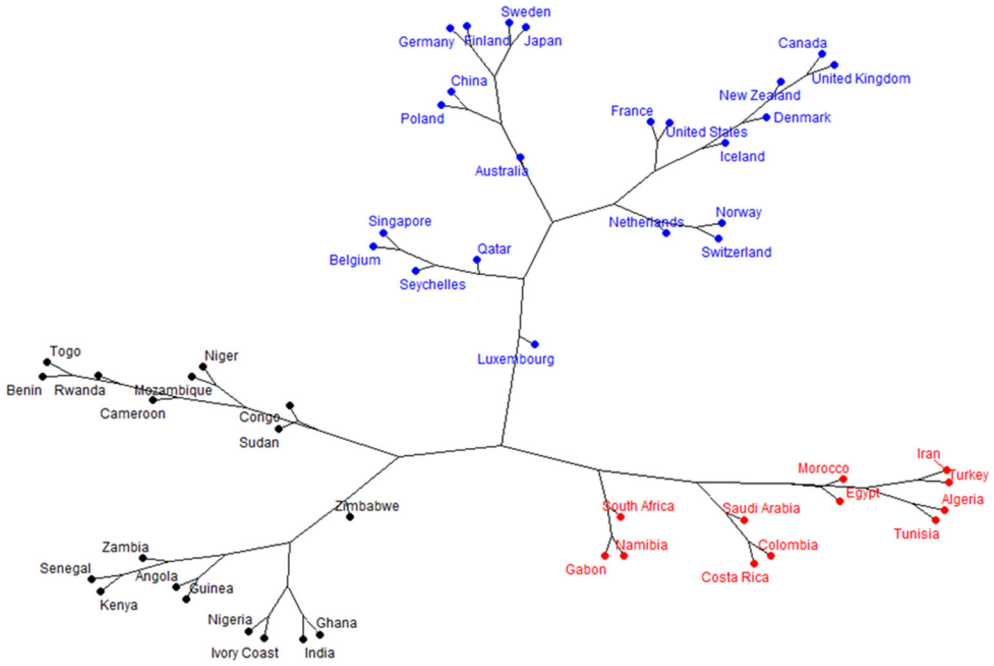


Figure 10. Tree representation 2010

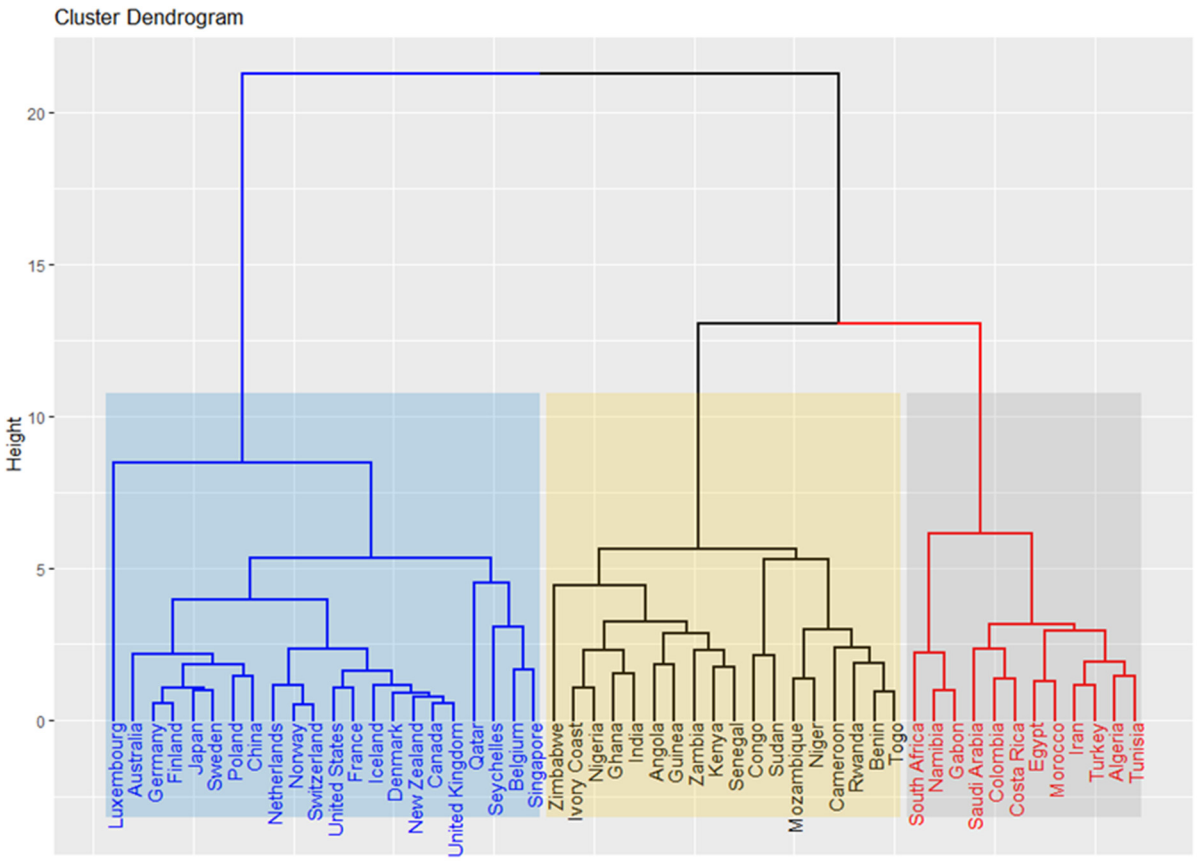


Figure 11. Countries classification in 2018

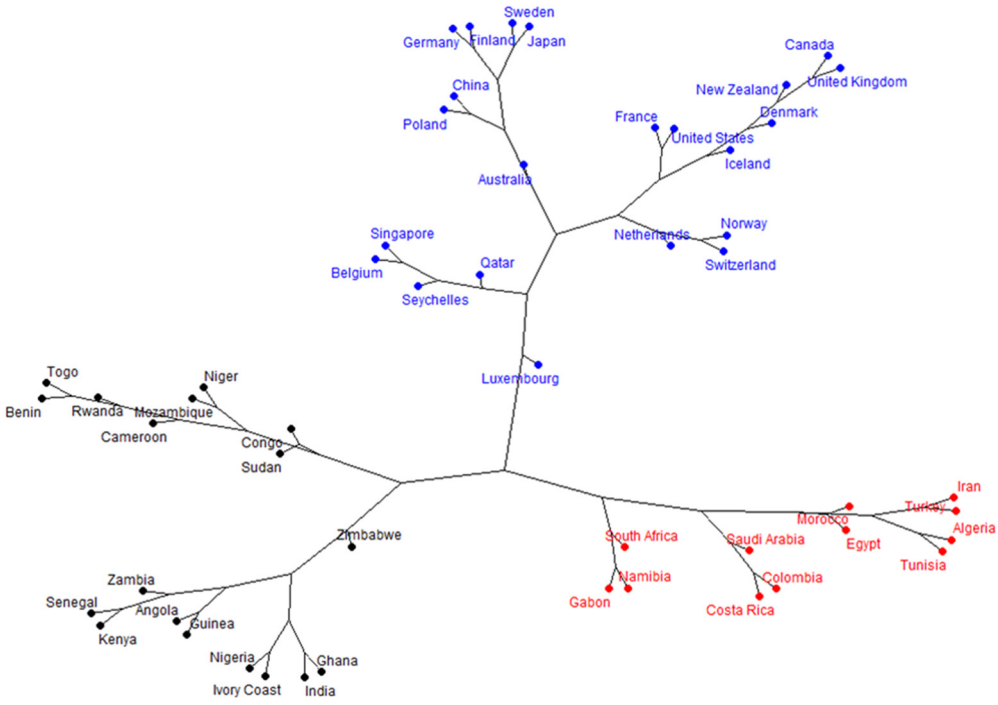


Figure 12. Tree representation 2018

Both the dendrograms above (Figure 9 and 11) suggest a breakdown of the countries in the sample into three groups, for both 2010 and 2018. For both periods, the country clusters highlighted using PCA are confirmed. According to both Figures 10 and 12 and for both the years 2010 and 2018, the distribution of countries in each group is translated by the leaves of the trees. The roots of the trees represent the three groups associated with the dimensions generated by the PCA. Each group of countries follows a well-defined axis.

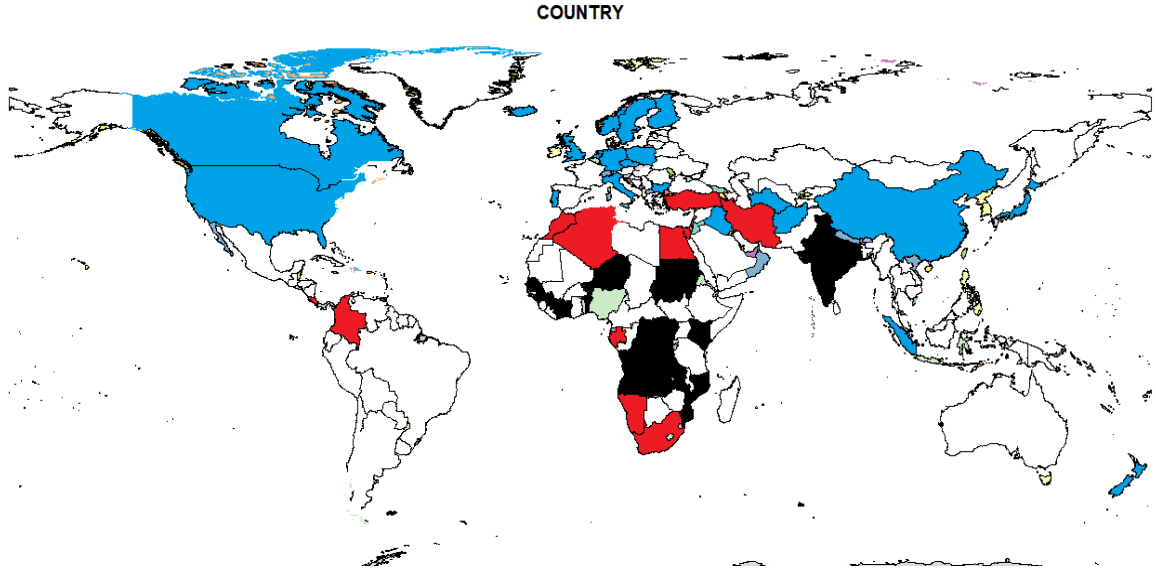


Figure 13. Geographic positioning of different country groups in 2018: Developed Countries (DC) in blue, Intermediate Countries (IC) in red and Less Developed Countries (LDC) in black

Using the R-Studio tool, we may graphically represent the geolocation of the three country clusters identified by this study for the year 2018 (Figure 13), employing a Choropleth map. This AI (artificial intelligence) mapping application allows us to clearly visualise the categorical clusters of human development. We highlight the existence

of a geographical concentration of countries in the two groups IC (red) and LDC (black) in the African continent and in South Asia (India).

It should also be noted that the composition of the two groups remained unchanged between 2010 and 2018, as can be seen from the juxtaposition of the two dendrograms in Figure 14 below.

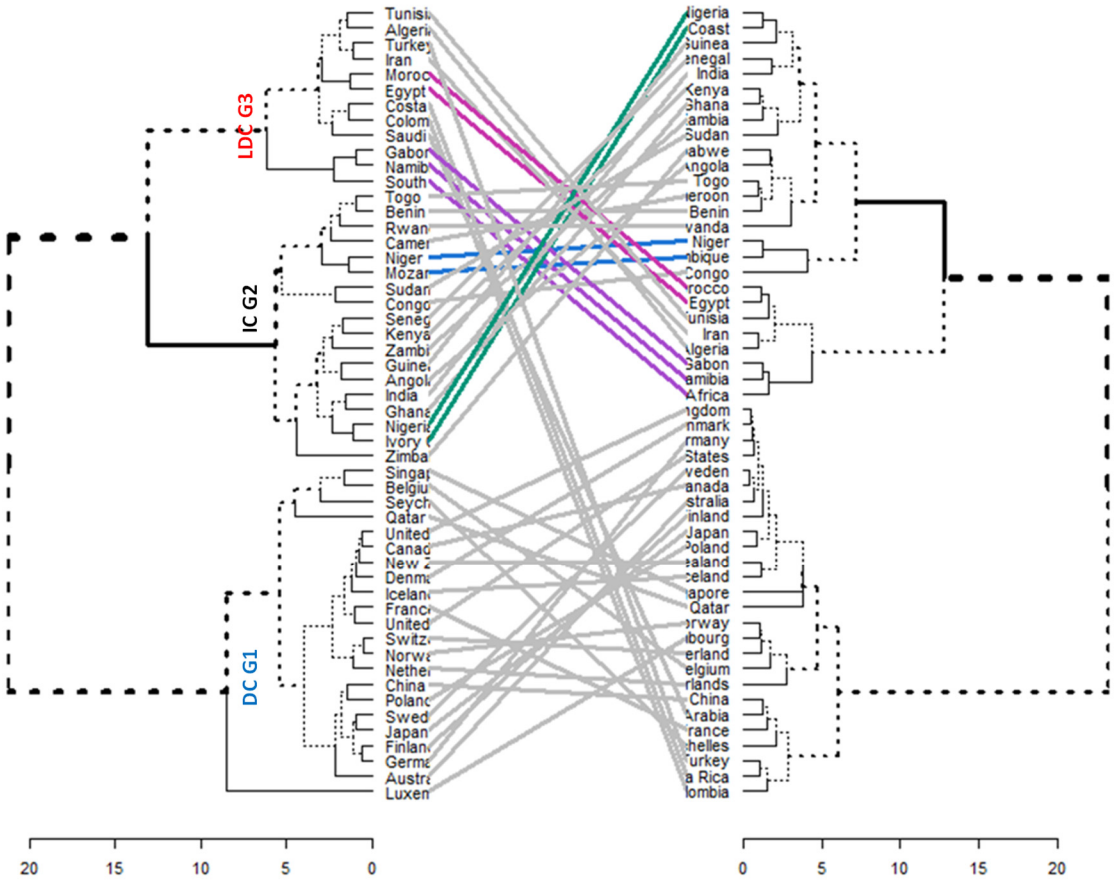


Figure 14. Country classification of two dendrograms 2018

Indeed, countries that were in a prosperous economic situation in 2010 (DC group) continue to be so in 2018. Countries with high unemployment (IC group) have not improved, and those with a fragile health system (LDC group) show no improvement between 2010 and 2018. Returning to the issues addressed in this work, we deduce that countries that had chosen a sustainability policy continue to follow it throughout the period, while those that oppose sustainability and attractiveness have not improved their strategy and persist in doing so. Between 2010 and 2018, the results show the absence of inter-group migration for all the countries in the sample, except for Saudi Arabia, which migrated from the IC group to the DC group. On the other hand, an intra-group effervescence is perceptible for almost all countries. While some countries in the LDC group are regressing (such as Sudan, which has dropped from 1st position to the 11th), others are making considerable progress. This is the case for Benin and Togo, which have moved from an intermediate position in 2010 to the top rankings in 2018. The same is true for Zimbabwe, which has made considerable progress. For the group of intermediate countries (ICs), the cases of Morocco and Egypt are revealing. While the former moves from the penultimate position to the 2nd position, the latter migrates from the 6th position to the 1st . On the other hand, Tunisia regresses from the 4th to 8th position.

Finally, for the DC Group the case of China deserves special attention. The country shows the consecration of a real "miracle" by moving from the 17th position to the 1st in the ranking of 21 countries of the DC group.

According to Chinese Official Data[4], it has made a significant leap towards sustainability: decrease in surface water pollution, increase in the share of renewable energy from 3% in 1978 to 14% in 2018; and 778 million people have been lifted out of absolute poverty. However, and despite this notable progress, these results should be handled with caution. China's ecological and social transition is described as "controversial and ambivalent". According to Giroir (2021), the sustainability tools used by the Chinese authorities have significant side effects and do not meet all sustainability criteria.

## 5. Longitudinal Data Analysis

In order to understand the effect of socio-economic indicators of attractiveness and sustainability on the Human Development Index, we have exploited the 52-country database over the period 2010 to 2018. The use of panel data, which incorporates the dual temporal and spatial dimension, has the advantage of increasing the sample size and improving the quality of the estimation.

The results of the panel data regression are used to verify, over the entire period, the results already obtained for the years 2010 and 2018 and to identify causal links. In addition, this approach will help us to test the possible existence of a country-specific effect over the entire study period and to compare the degree of importance of this effect within the period, taking into account the significance and impact of the explanatory factors, and also to explore, if necessary, this effect to validate the assignments to and the stability of the groups.

### 5.1 Regression Analysis on Panel Data

Before modelling, we link the evolution of the Human Development Index variable of interest for the countries in the sample, observed during the period 2010 to 2018, is represented in the graph below (Figure 15):

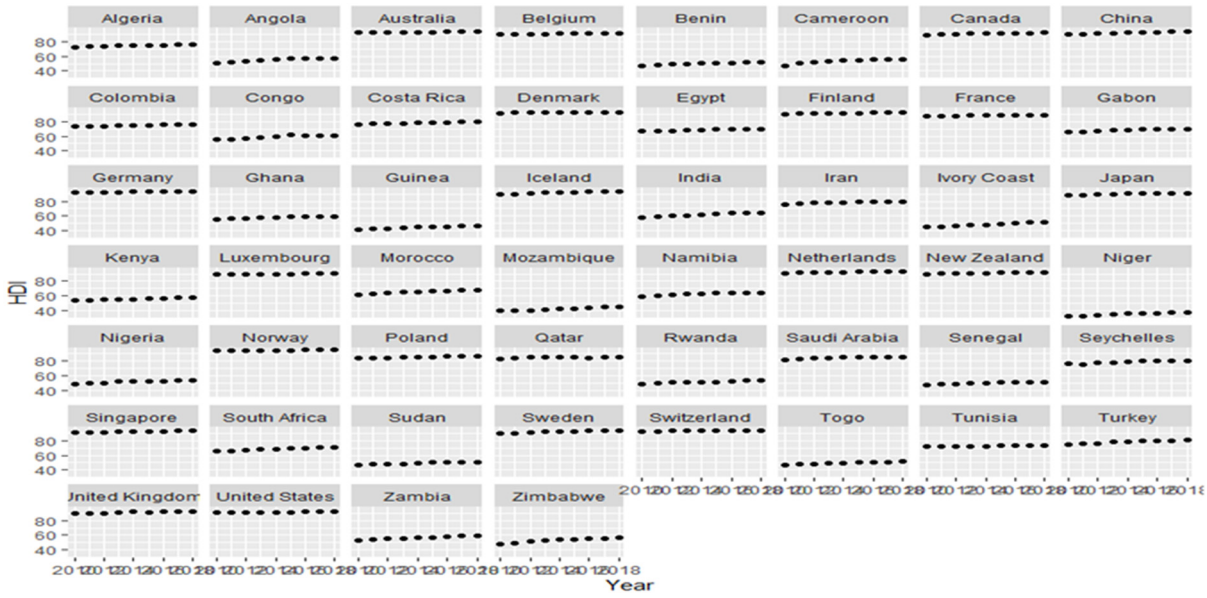


Figure 15. IDH variation by country during the period 2010-2018

For all countries, the curves are slightly increasing or nearby constant. Inter-country disparities are however observed. The extreme values are associated with Norway (maximum value 0.942 in 2010 and 0.954 in 2018) and Niger (minimum value of 0.319 in 2010 and 0.377 in 2018).

An econometric panel data model is next specified. The Human Development Index variable of interest is expressed as a function of the variables selected in the exploratory study above. The model to be estimated (Model 1) is the following:

The estimation of this model is subject to the standard tests associated with panel data (Test of Fisher, Breusch-Pagan and Haussman), as summarised in Table 2 below.

[4] China Statistical Yearbook (2019).

Table 2. Test statistic

| Test | Hypothesis | p-value | Decision |
|---|---|---|---|
| **Specification test** | Fixed effects absence<br>Fixed effects presence | 2.22 e-16 | Significant fixed effects |
| **Breusch – pagan** | Random effects absence<br>Random effects presente | 0.004 | Significant random effects |
| **Hausman Test** | Random effects<br>Fixed effects | 2.22 e-16 | Significant fixed effects |

The model chosen (Model 2, below) is therefore, a panel data model with individual fixed effects:

$$IDH_{i,t} = \alpha_i + \beta_1 IEduc_{i,t} + \beta_2 ChT_{i,t} + \beta_3 ILE_{i,t} + \beta_4 Int_{i,t} + \beta_5 GIn_{i,t} + \beta_6 MIn_{i,t} + \beta_7 E15p_{i,t} + \beta_8 IR_{i,t} + \beta_9 IED_{i,t} + \varepsilon_{i,t}, \quad (Model\ 2)$$
$$t = 1 \ldots T, \ \mathrm{i} = 1 \ldots = 52, \qquad T = 9 \ (2010\ to\ 2018)$$

The results of the estimation of this model by a maximum likelihood procedure are summarised in the following table (Table 3).

Table 3. Estimates of regression analysis

| | Estimate | Std. Error | t-value | Pr(>\|t\|) |
|---|---|---|---|---|
| **IEduc** | 0.3516970 | 0.0133875 | 26.2706 | < 2.2e-16 *** |
| **ChT** | -0.0339092 | 0.0216155 | -1.5687 | 0.117485 |
| **ILE** | 0.0030535 | 0.0023451 | 1.3021 | 0.193625 |
| **Int** | 0.0126409 | 0.0031116 | 4.0625 | 5.827e-05 *** |
| **Gin** | -0.0014759 | 0.0058061 | -0.2542 | 0.799468 |
| **Min** | -0.2155191 | 0.0093978 | -22.9330 | < 2.2e-16 *** |
| **E15p** | 0.0764621 | 0.0245181 | 3.1186 | 0.001946 ** |
| **IR** | 0.1317365 | 0.0222671 | 5.9162 | 6.994e-09 *** |
| **IED** | -0.0021900 | 0.0025654 | -0.8537 | 0.393779 |

The findings are:

- The coefficients associated with the education indicator (IEduc), internet access (Int), infant mortality (MIn), employment (E15p) and the income index (IR) are statistically significant.

-The effect of the variables (IEduc, Int, E15p and IR) on human development is significantly positive, while that of infant mortality is significantly negative.

- The unemployment rate and the economic freedom degree do not seem to have a significant effect on human development.

This panel study shows that, over the study period, countries that focused on education, digitalization, expanding employment opportunities, and implementing policies to reduce child mortality were the ones that were able to achieve high levels of human development. Attractiveness variables do not seem to affect human development.

These results suggest also to look beyond attractiveness. Countries have too often cringed under this assumption. While it is true that the presence of FDI is a signal of attractiveness, it is not a guarantee for balanced development. To go beyond attractiveness, it will be necessary to commit to confronting the complexity of human development in all its dimensions and face its systemic challenges. From health, nutrition, and education policies to employment policies, it appears that access to capital, social services, governance, and access to information, decision makers have a plethora of tools and choices that, if properly deployed according to the context and level of development of each country, will translate into higher levels of human development.

*5.2 Hierarchical Ascending Classification: Country Effect*

In order to verify the results already obtained – at the beginning of the period (2010) and at the end of the period (2018) – concerning the groups of countries, their classification and their membership, we used the results of the estimation of the fixed-effects panel model taking into account all 52 countries monitored over the entire period from 2010 to 2010 and introducing all the explanatory variables. Thus, we used the obtained estimates of the country effect to perform a new hierarchical ascending classification (HAC) of the data, according to the same criteria used in the first analysis (Wald criterion and squared Euclidean distance). The dendrogram below (Figure 16) summarizes the results finally obtained

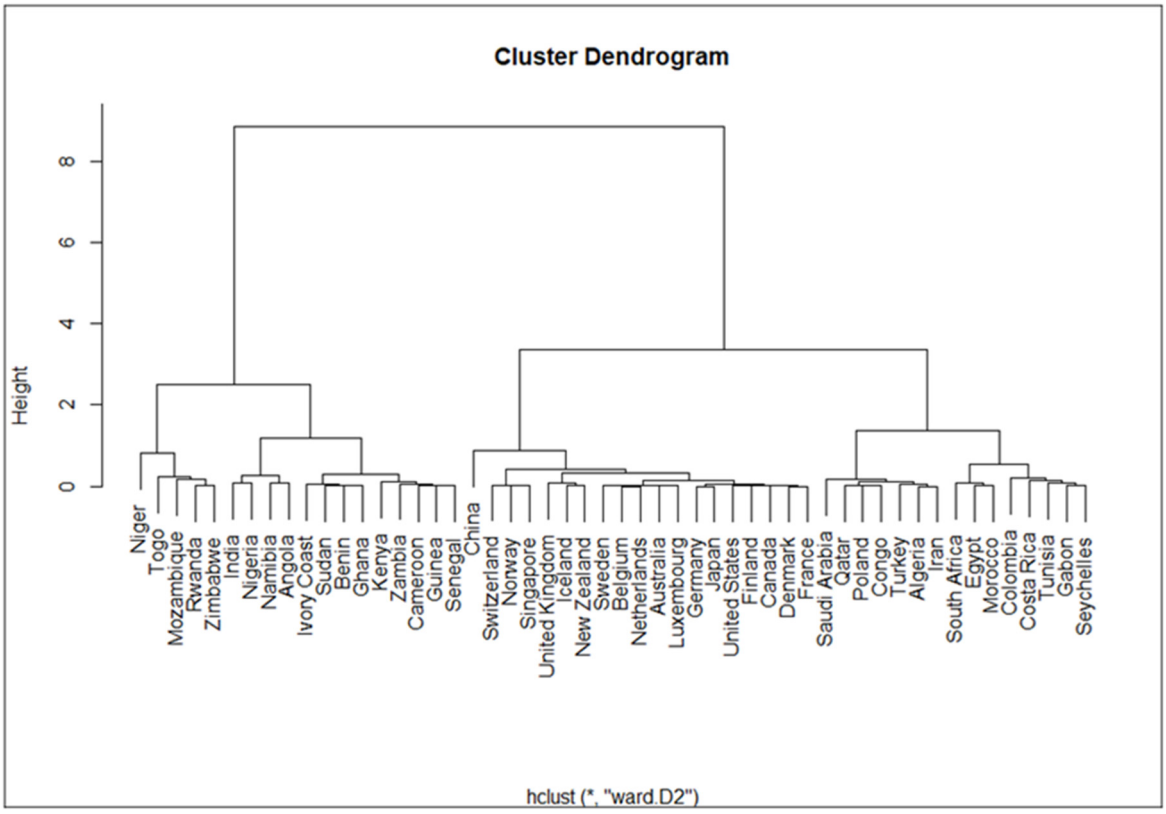


Figure 16. Dendrogram from the fixed effect model

The empirical results which have the advantage of being rather robust, confirm those established by considering only the beginning and end of the period. The time effect is therefore not significant and does not have a significant impact on the observations. However, the country effect is the most decisive. Indeed, the validity of the groups of countries, the three classes obtained (LDC, IC, DC) and the allocation of countries to the classes is confirmed.

**6. Conclusion**

In this study we have sought to assess the main trends in terms of the nexus attractiveness-sustainability, in order to make a typology according to the main orientations and to analyse the changes in different homogeneous groups of countries. The factorisation allowed us to identify three dimensions in 2010: Sustainability, Employment Outlook, and Attractiveness. In 2018, an equivalent percentage of explanation is achieved by only two components, viz. Sustainability and Employment Outlook. We were thus able to divide the countries into homogeneous groups according to these dimensions: Developed Countries (DC), Intermediate Countries (IC), and Least Developed Countries (LDC). Then we made a typology of countries that confirmed the distribution found. The juxtaposition of the results associated with these countries allowed us to conclude that there were no inter-group mutations. These are only noticeable at the intra-group level. The composition of the groups thus remained unchanged between 2010 and 2018, indicating a stable relationship between the Human Development Index and the other selected variables. Finally, we conducted an analysis of the longitudinal data. This allowed us to take into account the dual temporal and spatial dimension. The results of the regression led us to verify, over the entire study period, the conclusions already obtained by the PCA and the HAC. The Hausman specification test allowed us to retain

the model with individual fixed effects, revealing that the distribution and typology of countries are not random. They are related to the specificities and intrinsic characteristics of the different countries. Thus, the countries that have implemented education, digitalisation, employment, and health policies are those that have been able to achieve high levels of human development. Countries that have focused on attractiveness do not seem to be doing well.

Our results call for a reflection on the group of IC and LDC countries. These countries, despite a plethora of bilateral and multilateral declarations and agreements and a general consensus on the priority of SD, do not seem to be able to combine it in their development strategies. It is not surprising, therefore, that none of them managed to break out of the LDC group between 2010 and 2018. They do not seem to have succeeded in creating an enabling environment for sustainable and equitable development. The disparity between these countries is increasingly noticeable and growing. Their policies and strategies do not seem to be in line with sustainability imperatives. Of course, as we have shown, some of them have improved their ranking, but this is still not enough to move to another group. This is also true for the group of intermediate countries (IC). Only developed countries (DCs) that were in a prosperous economic situation in 2010 continue to be in a prosperous situation in 2018.

Being focused on the structural adjustment policies of the 1980s and 1990s, and under the watchful eye of international organisations, these countries have largely ignored environmental dimensions and long-term objectives. Since the early 2000s, and to align with the Millennium Development Goals (MDGs), these countries have focused on economic development and poverty reduction (Boidin and Djeflat, 2009). They have succeeded in adopting new approaches to agriculture or forestry, but these remain very focused on the short term and their financial implications (Jaquet and Loup 2009). These approaches have not led to considering the environment as a priority and key element of territorial development (Laganier and al. 2002), which, in turn, generates subsequent economic benefits.

It is true that international organisations have had to change the architecture of their aid to developing countries and are devoting more resources to environmental preservation and social equity. But the consideration of the environment as a key determinant of alternative development strategies was, and remains, obscured.

In addition, and apart from external aid, SD policy faces a problem of ownership by local institutions and communities (Djeflat and Boidin, 2010). It is often accompanied by difficulties in implementation and is pursued in the form of compartmentalised and sectoral approaches that have not been fully integrated into development strategies (Jacquet and Loup, 2009). Deployed in a fragmented manner, without reference and imperfectly linked to an overall strategy, human development continues to be unequal, exclusive, and vulnerable. The systemic and interdependent nature of sustainable development measures requires a comprehensive and integrated approach. Finally, it ought to be reiterated that a regional focus might have been an attractive option, but unfortunately a cross-regional comparative study is not feasible, given the lack of appropriate data. A viable research strategy might be to adapt a two-stage procedure, viz. (i) at the country level, and (ii) at a regional level for these countries for which regional data exist.

Future research could use the data-based tools of artificial intelligence to tap into the creative potential of each country. Deep learning in terms of knowledge management can reveal the internal and specific characteristics of each country. Territorial interdependencies may then be identified. The use of deep-learning algorithms may simulate the time needed to move to a higher level of development.

**Acknowledgement**

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| **Nomenclature** | |
|---|---|
| IDH | Human Development Index |
| IR | Income Index |
| Int | Internet Percentage |
| Gender Inequality Index | GIn |
| Education Index | IEduc |
| Infant mortality rate (per 1,000 live births) | MIn |
| Foreign direct investment Net inflow (% of GDP) | IED |
| Index of Economic Freedom | ILE |
| Employment to population ratio (percentage of 15+) | E15p |
| Total unemployment (% of population) | ChT |
| Developed Countries | DC |
| Less Developed Countries | LDC |
| Intermediate Countries | IC |
| Hierarchical Ascending Classification | HAC |
| Principal Component Analysis | PCA |

## Appendix

Table 1A Panel Model Estimates - Fixed Effect

```
plm(formula = IDH ~ IEduc + ChT + ILE + Int + GIn +
MIn + E15p + IR + IED, data = tab01, model = "within",
index = c("pays", "annee"))

Balanced Panel: n = 52, T = 9, N = 468

Residuals:
```

```
      Min.   1st Qu.    Median   3rd Qu.      Max.
-2.115765 -0.155580  0.019934  0.180120  1.655374
IEduc, Int,IR et MIn
Coefficients:
             Estimate   Std. Error   t-value      Pr(>|t|)
IEduc       0.3516970  0.0133875    26.2706      < 2.2e-16 ***
ChT        -0.0339092  0.0216155    -1.5687       0.117485
ILE         0.0030535  0.0023451     1.3021       0.193625
Int         0.0126409  0.0031116     4.0625       5.827e-05 ***
Gin        -0.0014759  0.0058061    -0.2542       0.799468
Min        -0.2155191  0.0093978   -22.9330      < 2.2e-16 ***
E15p        0.0764621  0.0245181     3.1186       0.001946 **
IR          0.1317365  0.0222671     5.9162       6.994e-09 ***
IED        -0.0021900  0.0025654    -0.8537       0.393779
signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Total Sum of Squares:    1011.9
Residual Sum of Squares: 58.557
R-Squared:      0.94213
Adj. R-Squared: 0.9336
F-statistic: 736.211 on 9 and 407 DF, p-value: < 1.12e-16
```

Table 2A Panel Model Estimates - Random Effect

```
plm(formula = IDH ~ IEduc + ChT + ILE + Int + GIn +
MIn + E15p + IR + IED, data = tab01, model = "random",
    index = c("pays", "annee"))

Balanced Panel: n = 52, T = 9, N = 468
Effects:
                    var std.dev share
idiosyncratic 0.1439   0.3793 0.023
individual    6.2167   2.4933 0.977
theta: 0.9494
Residuals:
      Min.   1st Qu.    Median   3rd Qu.      Max.
-2.420094 -0.135700  0.025346  0.158694  2.063938
Coefficients:
               Estimate  Std. Error  z-value  Pr(>|z|)
(Intercept) 36.4340643 2.0323172  17.9274   < 2.2e-16 ***
IEduc        0.3690554  0.0136511   27.0348  < 2.2e-16 ***
ChT         -0.0335433  0.0220618   -1.5204  0.128404
ILE          0.0030690  0.0024832   1.2359   0.216493
Int          0.0085902  0.0031661   2.7132   0.006663 **
```

| | | | | |
|---|---|---|---|---|
| GIn | -0.0080299 | 0.0060181 | -1.3343 | 0.182106 |
| Min | -0.1996148 | 0.0095080 | -20.9944 | < 2.2e-16 *** |
| E15p | 0.0170216 | 0.0211434 | 0.8051 | 0.420789 |
| IR | 0.2170145 | 0.0177869 | 12.2008 | < 2.2e-16 *** |
| IED | -0.0014331 | 0.0027209 | -0.5267 | 0.598383 |

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Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Total Sum of Squares: 1398.9

Residual Sum of Squares: 74.441

R-Squared: 0.94678

Adj. R-Squared: 0.94574

Chisq: 8148.56 on 9 DF, p-value: < 2.22e-16

Table 3A Hausman Test

**Hausman Test**

data: IDH ~ IEduc + ChT + ILE + Int + GIn + MIn + E15p + IR + IED

chisq = 23.858, df = 9, p-value = 0.004531

alternative hypothesis: one model is inconsistent