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A Novel Method to Structure the World in Population Entities and Application to European Countries and Regions

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A Novel Method to Structure the World in Population Entities and Application to European Countries and Regions

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Abstract

A novel method is presented to describe population entities. It consists of two steps. First the structure of a population entity is described in terms of sub entities using a logarithmic distribution. This allows the uniform description of the World in continents, continents in countries, countries in provinces, provinces in cities, etc. Secondly the logarithmic distribution is simplified. This reveals the main structural differences and similarities at a certain level (countries in terms of provinces for example) and opens a window to study scale effects (comparing for example the description of a province in cities and the world in terms of countries).

The novel method is applied to the description of the EU and its member states. The five cultural dimensions of Hofstede are reduced to three and a new sequential analysis gives three major EU-regions. A parameter of the novel method is related to one of these three cultural dimensions. The results are discussed in terms of sustainable development of the EU, its regions and its member states and sub-societies.

Keywords: Countries, Cultural Dimensions, EU, Member States, Politics, Population, Regions, Structure, Sustainable Development

1 Introduction

Sustainable development is carried out by persons. Together they form small societies (families, SME's, villages) and by cooperation they bring sustainable development on a higher level. The highest level is sustainable development on a global scale, the actors being countries and multinationals. At each level societies will have different structures and cultural identities. Structural and cultural diversity are required to increase chances, as the pathway to sustainable development is and will be unknown. The research question is how this march towards sustainable development, by interacting smaller and larger societies, can be directed forward more efficiently.

To address this problem a link is needed between structure and culture of societies. Hofstede [1] describes cultural identity on country level in terms of 5 values. What lacks is a model to structure the population of societies on every scale. Recently, a model was proposed by Kleizen [2].

In this paper, the new model is presented again and applied on the level of EU and its member states. The Hofstede scheme of five indexed cultural

values is simplified to the sequence of three, allowing focus on similarities. This novel analysis method is applied to the EU and member states as well, giving rise to three major EU regions. A relationship between the new population model and cultural value is given. The results are discussed in the perspective of sustainable development of the EU in the World.

2 Population Model Societies

The population of a society can be classified using a logarithmic distribution commonly used in the world of filtration. The population is described by 2^N with N an integer and therefore a class width of 2. (In each class the number of people varies from $N/\sqrt{2}$ up to $N\sqrt{2}$.)

In the CIA World Factbook [3] one counts 236 counties (nations, dependent areas and other entities) permanently populated by 6.446 billion people (July 2005 estimate). In Figure 1 the distribution of the World population over the 236 countries is compared with the European population over its 50 countries (CIA nomenclature with the exception of including Cyprus).

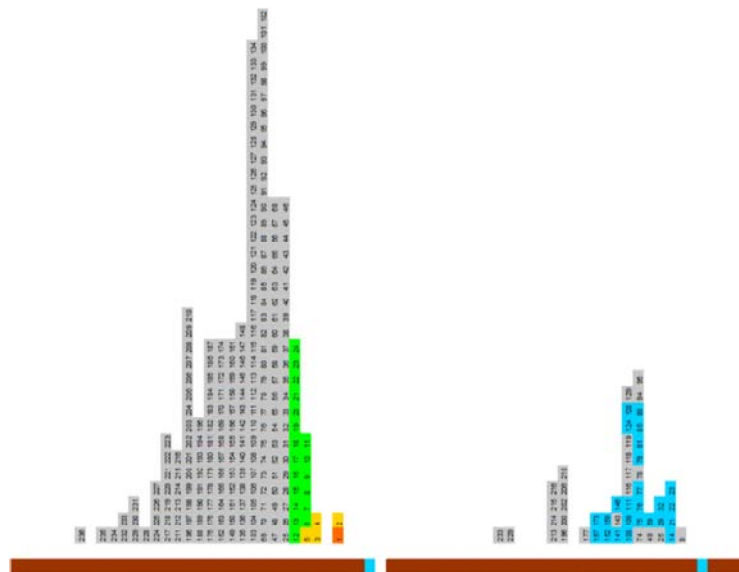


Figure 1: The distribution of populations over countries in terms of N . Left: World population over 236 countries. Right: European population over 50 countries including Cyprus.

The World population falls in class $N=33$. The largest countries, China and India, are in class $N=30$ and the smallest one – the Pitcairn Islands – with a population of 46, are in class $N=6$. The population of Europe has the N -value 29. The largest entity is Russia ($N=27$) and the smallest the Holy See (Vatican City), with 932 people, falling in class $N=10$.

To describe societies top down a second variable is introduced: the order m of the distribution. The order m is equal to difference between the N -value of the society and the one of the largest sub-society. Thus the world has the order 3

(33-30=3) and for Europe $m=2$ (29-27=2). To complete the top-down description three indices hkl are introduced, satisfying the condition,

$$2^N = h \cdot 2^{N-m} + k \cdot 2^{N-m-1} + l \cdot 2^{N-m-2} \quad (1)$$

with $l, k=0,1,2,3$ and $h=1,2,3, \dots$ since there is at least 1 largest sub-society. The number of hkl solutions is equal to 4^m as can be verified from Table 1. To avoid confusion the k -indices are underlined>.

Table 1: The $h\bar{k}l$ solutions for $m=0,1$ and 2.

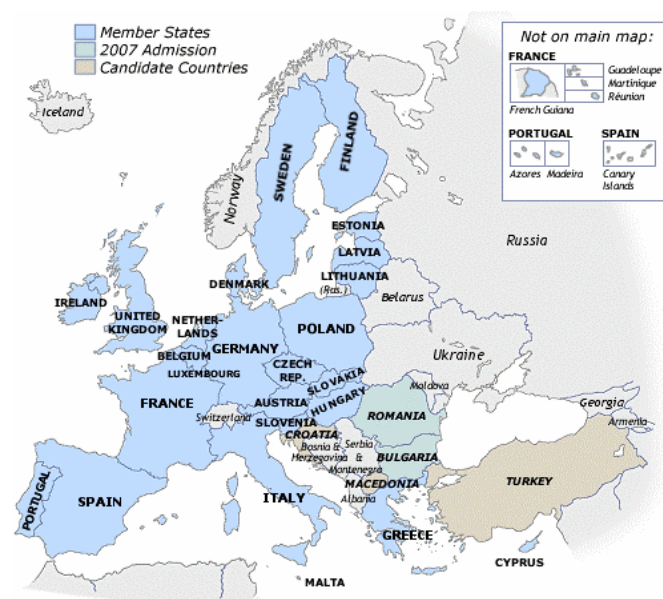
m=0	m=1		m=2			
$h\bar{k}l$	$h\bar{k}l$	$h\bar{k}l$	$h\bar{k}l$	$h\bar{k}l$	$h\bar{k}l$	$h\bar{k}l$
100	200	120	400	320	240	160
		112		312	232	152
		104		304	224	144
					216	136
					208	128
						1110
						1012

The world with $N=33$, $m=3$, $h=2$ (China and India), $\bar{k}=\underline{0}$ (no country with $N=29$) gets then an l -value of 24 as calculated from equation (1). Europe with $N=29$, $m=2$, $h=1$ (Russia), $\bar{k}=\underline{4}$ (Germany, France, United Kingdom and Italy) gets an l -value of 4.

3 Population structure EU and EU-countries

The EU roots in the after match of the World War II. It started with 6 continental countries in the early 1950's and half a century later its member states add up to 15. Nowadays (see Figure 2) it is a supranational union of

Figure 2: The 25 member states of the European Union.



25 democratic countries and the foreseeable enlargement in 2007 will increase this number to 27. A change in the number of member states of the EU does not necessarily change its description in terms of the five parameters. In Table 2 the evolution of the EU is given, highlighting the years of major enlargement.

Table 2: A history of EU evolution as sensed by the novel population model.

EU		Population est	Parameters				
			N	m	h	<u>k</u>	l
1952	EU-6	1.6E+08	27	1	1	<u>2</u>	0
1973	EU-9	2.6E+08	28	2	4	<u>0</u>	0
1986	EU-12	3.3E+08	28	2	4	<u>0</u>	0
1995	EU-15	3.7E+08	28	2	4	<u>0</u>	0
2004	EU-25	4.6E+08	29	3	4	<u>2</u>	12
2007	EU-27	4.9E+08	29	3	4	<u>2</u>	12

In the beginning, the population structure was dominated by West Germany ($h=1$, $N=26$), Italy and France ($\underline{k}=2$, $N=25$). Population growth and the membership of the United Kingdom changed the EU to an $N=28$ community, increasing the distance (m) between the EU and its largest 4 $N=26$ communities West Germany, United Kingdom, Italy and France. The reign of these 4 countries lasted not longer than 21 years and ended in 2004 when the distance between the $N=29$ EU community and its largest members ($h=4$, $N=26$) was again enlarged ($m=3$) giving room for influence of smaller countries (Spain and Poland: $\underline{k}=2$, $N=25$).

The five parameter model can also be applied to countries themselves, taking administrative subdivisions as the smaller sub-societies. The choice of administrative subdivisions is a difficult and ambiguous one (political power

Table 3: Population structure of the EU-27 member states of 2007.

Country			Population July2005est	Parameters				
	internet	nr		N	m	h	<u>k</u>	l
Austria	at	89	8184691	23	2	2	<u>2</u>	4
Belgium	be	77	10364388	23	2	1	<u>6</u>	0
Bulgaria	bg	95	7450349	23	2	2	<u>3</u>	2
Cyprus	cy	159	780133	20	2	2	<u>1</u>	6
Czech Republic	cz	79	10241138	23	3	5	<u>6</u>	0
Denmark	dk	108	5432335	22	3	6	<u>4</u>	0
Estonia	ee	152	1332893	20	1	1	<u>0</u>	4
Finland	fi	111	5223442	22	2	1	<u>3</u>	6
France	fr	21	60656178	26	3	1	<u>4</u>	20
Germany	de	14	82431390	26	2	2	<u>3</u>	2
Greece	gr	75	10668354	23	1	1	<u>1</u>	2
Hungary	hu	81	10006835	23	2	2	<u>4</u>	0
Ireland	ie	124	4015676	22	1	1	<u>1</u>	2
Italy	it	23	58103033	26	3	1	<u>8</u>	12
Latvia	lv	141	2290237	21	2	1	<u>0</u>	12
Lithuania	lt	128	3596617	22	2	1	<u>2</u>	8
Luxembourg	lu	167	468571	19	2	2	<u>0</u>	8
Malta	mt	173	398534	19	2	1	<u>4</u>	4
Netherlands	nl	59	16407491	24	2	1	<u>3</u>	6
Poland	pl	32	38557984	25	3	4	<u>7</u>	2
Portugal	pt	76	10566212	23	2	2	<u>2</u>	4
Romania	ro	49	22329977	24	3	1	<u>2</u>	24
Slovakia	sk	109	5431363	22	2	2	<u>4</u>	0
Slovenia	si	146	2011070	21	3	1	<u>1</u>	26
Spain	es	29	40341462	25	2	2	<u>2</u>	4
Sweden	se	85	9001774	23	2	2	<u>1</u>	6
United Kingdom	uk	22	60441457	26	3	3	<u>6</u>	8

administrative subdivision). The results for the UE-27 countries of 2007 are presented in Table 3. They are based upon the world wide system of geohive [4] rather than the Eurostat NUTS system [5] not recognizing structure in smaller states and having no worldwide ambition. Some countries have identical values for the parameters m and h, \underline{k} , l. The 6 sets are: Austria, Portugal and Spain (m=2, h=2, \underline{k} =2, l=4), Bulgaria and Germany (m=2, h=2, \underline{k} =3, l=2), Cyprus and Sweden (m=2, h=2, \underline{k} =1, l=6), Finland and the Netherlands (m=2, h=1, \underline{k} =3, l=6), Greece and Ireland (m=1, h=1, \underline{k} =1, l=2) and Hungary and Slovakia (m=2, h=2, \underline{k} =4, l=0). These sets are excellent cases to answer the question whether or not these administrative subdivisions per state can be found back in its cultural roots.

4 Cultural values

Hofstede [1] describes countries in terms of five index values: Power distance (PDI), Uncertainty Avoidance (UAI), Individuality (IDV), Masculinity (MAS) and Long Term Orientation (LTO).

A list of estimated values based upon research for EU-27 countries is given in Table 4.

Table 4: Estimated values for the Hofstede [1] dimensions of EU-27 countries.

*: inferred data, from observations and cultural aspects not estimated by research.

Country			Population July2005est	Cultural Values					sequence
	internet	nr		A = LTO	B = PDI	C = UAI	D = IDV	E = MAS	
Austria	at	89	8184691	31	11	70	55	79	ECDAB
Belgium	be	77	10364388	38	65	94	75	54	CDBEA
Bulgaria*	bg	95	7450349		70	85	30	40	CBED
Cyprus	cy	159	780133						
Czech Republic*	cz	79	10241138	13	57	74	58	57	CDB=EA
Denmark	dk	108	5432335	46	18	23	74	16	DACBE
Estonia*	ee	152	1332893		40	60	60	30	C=DBE
Finland	fi	111	5223442	41	33	59	63	26	DCABE
France	fr	21	60656178	39	68	86	71	43	CDBEA
Germany	de	14	82431390	31	35	65	67	66	DECBA
Greece	gr	75	10668354		60	112	35	57	CBED
Hungary*	hu	81	10006835	50	46	82	80	88	ECDAB
Ireland	ie	124	4015676	43	28	35	70	68	DEACB
Italy	it	23	58103033	34	50	75	76	70	DCEBA
Latvia	lv	141	2290237						
Lithuania	lt	128	3596617						
Luxembourg*	lu	167	468571		40	70	60	50	CDEB
Malta*	mt	173	398534		56	96	59	47	CDBE
Netherlands	nl	59	16407491	44	38	53	80	14	DCABE
Poland*	pl	32	38557984	32	68	93	60	64	CBEDA
Portugal	pt	76	10566212	30	63	104	27	31	CBEAD
Romania*	ro	49	22329977		90	90	30	42	B=CED
Slovakia*	sk	109	5431363	38	104	51	52	110	EBDCA
Slovenia	si	146	2011070		71	88	27	19	CBDE
Spain	es	29	40341462	19	57	86	51	42	CBDEA
Sweden	se	85	9001774	33	31	29	71	5	DABCE
United Kingdom	uk	22	60441457	25	35	35	89	66	DEB=CA

As remarked by Kleizen in Gonz et al [6] the sequence of numerical values is perhaps important and there are only $5! = 120$ different sequences. EU-27 countries with the same sequence are not always neighbours: Austria and Hungary* (ECDAB), Belgium, Czech Republic* and France (CDBEA), Bulgaria*, Greece and Romania* (CBED), Estonia*, Malta* and Slovenia

(CBDE), .Finland and the Netherlands (DCABE), Germany and United Kingdom (DECBA).

That not all 120 sequences occur can be the result of relationships between the cultural values allowing only for certain sequences. For the EU-27 countries the value of the PDI (=B) is usually smaller then the value of the UAI (=C) index. Thus the sequence CB (value for C larger then for B) occurs much more frequently then the sequence BC. The values PDI and UAI may very well have an evolutionary origin coming respectively first and second chronologically (Kleizen [7]). The third one in that perception is individuality IDV (=D). In Table 5, the history of the EU is shown in terms of cultural values and sequences.

Table 5: A history of the EU in terms of cultural values and sequences.
Effect of change in populations upon index values less then 1% absolute.

EU		Population est	Parameters					5-seq	3-seq
			B = PDI	D = IDV	E = MAS	C = UAI	A = LTO		
1952	EU-6	1.6E+08	50.2	72.0	56.9	74.5	35.3	CDEBA	CDB
1973	EU-9	2.6E+08	45.9	75.7	58.0	64.2	33.4	DCEBA	DCB
1986	EU-12	3.3E+08	48.3	70.0	55.0	69.7	31.6	DCEBA	DCB
1995	EU-15	3.7E+08	46.3	69.5	54.3	68.3	31.7	DCEBA	DCB
2004	EU-25	4.6E+08	49.2	68.2	56.3	70.7	31.9	CDEBA	CDB
2007	EU-27	4.9E+08	51.4	65.8	55.4	71.8	31.9	CDEBA	CDB

The EU started with the CDB sequence, enlarged in 1973 and changed to the DCB sequence after which it expanded in 2004 to return to its original sequence.

There are $3! = 6$ possible sequences of B, C and D, but the dominance of the sequence CB noted for EU-countries nearly reduces it to three. See Table 6.

Table 6: Frequency distribution of sequences of B, C and D of EU-27 countries.
Countries with equal values of indexes are listed under all possible sequences.
Example Romania : B=C=90, D=30: sequences BCD and CBD

3sequence	EU-27 country							
BCD	sk	ro						
BDC								
DBC	se	uk						
DCB	dk	ee	fi	de	ie	it	nl	uk
CDB	at	be	cz	ee	fr	hu	lu	mt
CBD	bg	gr	pl	pt	ro	si	es	

The EU-27 described in terms of the three sequences DCB, CDB and CBD gives the following three regions (see also Figure 2):

1. A South North axis with sequence DCB running from Italy up to Denmark and branching to the East to Finland and to the west to Ireland.
2. CDB countries surround the middle, around the axis.
3. The CDB countries are embedded in a larger semicircle of CBD countries running from Portugal in the South West via Greece to the North East in Poland.

Within each region, strong but different relationships between C (=UAI) and B (=PDI) are found. They are depicted in Figure 3. The bottom right picture is the sum off the other three pictures. Each of these three pictures shows a

solid line, which is the regression line for all EU-countries. The dotted line is the regression line for a given sequence (DCB, CDB, CBD) and the average PDI and UAI values for a given sequence are shown by the hourglass symbol.

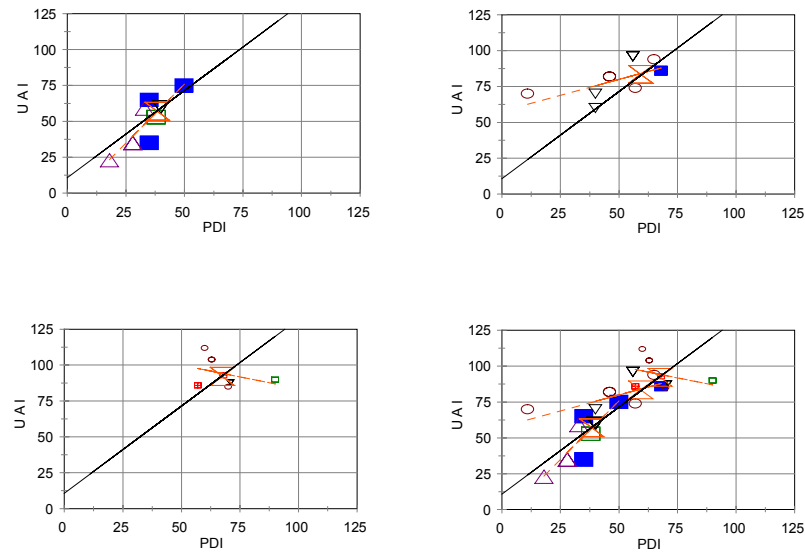


Figure 3: UAI as a function of PDI of EU-27 countries for sequences DCB, CDB and CBD. Top left: DCB, Top right: CDB, Bottom left: CBD, Top right: all 3 sequences. Dotted line: regression for given sequence, hourglass symbol: average values given sequence. Solid line: regression all 3 sequences.

The Uncertainty Avoidance Index increases strongly with increasing Power Distance Index in DCB countries (Figure 3 top left). In CDB countries this increase is weakened (Figure 3 top right) turning into a weak decrease in CBD countries (Figure 3, bottom left). **The overall regression**, as well as the sequential averages show that UAI increases with PDI. The sequential regression lines also demonstrate effects of saturation (CDB) and decline (CBD) related to the absolute values of these values C and B.

5 Population model and cultural values

The relationship between a society and its sub-societies in the new population model will depend on the parameter m in combination with the index h . The fraction r describes the relative influence of the largest sub-societies,

$$r = \frac{h \cdot 2^{N-m}}{2^N} = \frac{h}{2^m} \quad (2)$$

In Table 7, the evolution of the EU is written in terms of this modelled population fraction of all largest sub-societies too.

Table 7: EU-27 evolution in terms of B,C,D-sequence and r.

EU		Population est	r	3-seq
1952	EU-6	1.6E+08	0.5	CDB
1973	EU-9	2.6E+08	1	DCB
1986	EU-12	3.3E+08	1	DCB
1995	EU-15	3.7E+08	1	DCB
2004	EU-25	4.6E+08	0.5	CDB
2007	EU-27	4.9E+08	0.5	CDB

Apparently the EU-27 evolution written in r is the same as written in the D,C,B-sequence suggesting a connection.
 In Figure 4, the fraction r is plotted as a function of PDI in the same way as UAI is plotted versus PDI in Figure 3.

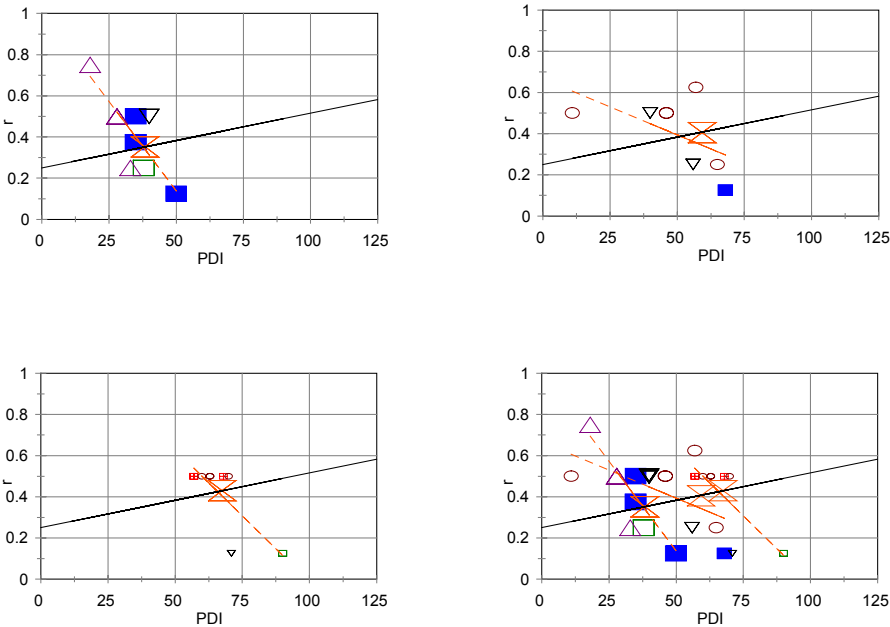


Figure 4: Population fraction of largest sub-societies of EU-27 countries for sequences BCD, CDB and CBD. Top left: DCB, Top right: CDB, Bottom left: CBD, Top right: all 3 sequences See also legend Figure 3.

For DCB countries (Figure 4 top left) a strong decrease in r is found with increasing value for PDI. The CDB countries give a more disperse picture within a smaller r-range but larger PDI range resulting in a weaker decrease in r with increasing PDI. The strong decrease in r with increasing PDI is restored in the CBD countries. Regression including all sequences (solid line) and sequential averages of the three regions show a weak increase with PDI value. A model which takes into account not only relative aspects and parameters can perhaps explain these somewhat conflicting statements.

6 Discussion

The Holy Grail is to find societies with an internal structure and value system to safeguard and direct sustainable development. The new population structure model and the new 3-sequential view on values may develop in a valuable tool for policymakers in societies to catalyse the formation of sustainable alliances.

The EU (CBD) can form strategic alliances with smaller societies such as the US (DCB) or larger ones: India (BDC) and China (BCD), transform itself into for example a major South America CBD-sequence, integrating with Russia (CBD), or optimize its own internal structure.

The latter option is explored in this paper using these new findings. The EU has then to recognize its three major regions DCB, CDB and CBD first, and let them cooperate in a sensible way recognizing cultural differences and different attitudes towards change and innovation.

It also has the task to structure the population in an explicit way, finding ways to strengthen the link between government and cultural diversity. That such a link exists, has been shown in this paper and is evident enough, but it must also be remarked that culture and administrative subdivisions to much extent are treated as independent phenomena.

Pending these actions, a study of these three regions would be most welcomed and separately a study on the level of EU-countries to disclose the effect of similarities and differences in population structure parameters and B,C,D-sequences.

7 Conclusions

The novel method to describe societies into sub-societies is applicable on the level of EU and its member states.

The five Hofstede values are analysed in a new way characterizing a society with the sequence of three of them (PDI, UAI and INV) and are applied to define three major EU regions.

A derived parameter of the novel method - the population fraction of the largest sub-societies- is linked to the Hofstede's Power Distance Index, allowing to strengthen the role of sub-societies in sustainable development in the future.

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