Geovisualization and analysis of the Good Country Index

C Tan¹ and K Dramowicz²
¹ DHI Water & Environment (S) Pte. Ltd, Singapore
² Centre of Geographic Sciences, Nova Scotia Community College, Lawrencetown, NS, Canada

E-mail: tan.cornelia@gmail.com konrad.dramowicz@nscc.ca

Abstract. The Good Country Index measures the contribution of a single country in the humanity and health aspects that are beneficial to the planet. Countries which are globally good for our planet do not necessarily have to be good for their own citizens. The Good Country Index is based on the following seven categories: science and technology, culture, international peace and security, world order, planet and climate, prosperity and equality, and health and well-being. The Good Country Index is focused on the external effects, in contrast to other global indices (for example, the Human Development Index, or the Social Progress Index) showing the level of development of a single country in benefiting its own citizens. The authors verify if these global indices may be good proxies as potential predictors, as well as indicators of a country’s ‘goodness’.

Non-spatial analysis included analyzing relationships between the overall Good Country Index and the seven contributing categories, as well as between the overall Good Country Index and other global indices. Data analytics was used for building various predictive models and selecting the most accurate model to predict the overall Good Country Index. The most important rules for high and low index values were identified. Spatial analysis included spatial autocorrelation to analyze similarity of index values of a country in relation to its neighbors. Hot spot analysis was used to identify and map significant clusters of countries with high and low index values. Similar countries were grouped into geographically compact clusters and mapped.

1. The Good Country Index

The Good Country Index was developed by Simon Anholt (http://www.goodcountry.org/overall), a policy advisor, strategist, and author of the idea of measuring nation brands. The Good Country Index shows the cumulative contribution of 125 countries towards the benefit of the world in the technological, cultural, peace-related, world orderliness, environmental, prosperity, and health well-being aspects, thus making up the seven categories of the Good Country Index (figure 1). The Index is based on these seven categories and five variables within each category for 125 countries for year 2010, when most of data were available (but still some countries have missing data). Data came from the United Nations and international organizations.

The whole idea of the Good Country Index is based on the assumption that ordinary people do not benefit from globalization as much as big corporations do. Therefore, people from around the world should work together not only locally but also globally. Good countries contribute to the whole planet, making it better, safer, richer, and fairer, and also country-level problems cannot be solved while ignoring the international (global) context. Finally, countries depend on their international reputation.
These are the main premises for the idea of a good country. Countries receive scores on each single variable as a fractional rank (0=top rank, 1=lowest) relative to all countries with available data. The category rankings are arithmetic means of fractional ranks on the five variables per category (allowing for a maximum of two missing values per category). The overall rank is based on the arithmetic mean of category ranks. As a result, the index provides an overall ranking and rankings for each of seven categories for each of 125 countries (figure 2).

![Figure 1. The structure of the Good Country Index.](image)

Countries described by the index do not necessarily have to be good for their own citizens, because the index does not look at the existing infrastructure that makes up the development and dynamics of countries, but rather focuses only on countries’ external outputs. In contrast, other global indices (e.g., the Human Development Index and Social Progress Index) that measure and rank countries in terms of their existing infrastructure. If we can substitute the category components of the Good Country Index with other global indices that correspond to the respective category component, we may be able to use the global indices as proxy indicators to evaluate a country’s ‘goodness’.

This paper focuses on exploratory analysis to find out if the use of global indices may be suitable as proxies to account for countries’ ‘goodness’ in the Good Country Index, as well as geovisualization through mapping of the Good Country Index, in relation to its corresponding global indices. It must be emphasized that this analysis investigates the strength of correlation between variables without referring to their causation. Hence no strong judgement is made when attempting to relate the Index with other global indices.

Figure 3 shows the top ten and bottom ten countries according to the overall Good Country Index and its seven categories. For the size of its economy and a combined score in all seven categories, Ireland outranks 124 other nations in contributing the most good to the global community. Nine European countries hold positions in the top 10 spots, making this region the most significant ‘cluster of goodness’ in the world. Americans take a low ranking in the 'International Peace and Security' category (114). The highest ranked countries outside of Western Europe and primary English-speaking nations are Costa Rica (22), Chile (24), and Guatemala (29). The African nation which contributes
most to the global commons is Kenya (26) which is the only African country to break into the top 30. Libya holds the last spot in the Good Country Index, next to Iraq and Vietnam. Russia ranks 95th overall, close to such nations as Honduras, Kuwait, and the Democratic Republic of the Congo (http://www.businessinsider.com/good-country-index-2014-6).

![Good Country Index Overall Ranks](image)

**Figure 2.** Good Country Index Overall and ranks for all its categories (shorter bars are higher ranks)

| Good Country Index                  | Top Ten Countries                                                                 | Bottom Ten Countries                                                                 |
|------------------------------------|-----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| Overall Rankings                    | Ireland, Finland, Switzerland, Netherlands, New Zealand, Sweden, United Kingdom, Norway, Denmark, Belgium | Yemen, Venezuela, Benin, Indonesia, Zimbabwe, Angola, Azerbaijan, Iraq, Vietnam, Libya |
| Science and Technology              | United Kingdom, Austria, Cyprus, Czech Republic, Israel, Switzerland, Finland, Sweden, Hungary, New Zealand | Bolivia, Venezuela, Sudan, Cambodia, Paraguay, Republic of Congo, Indonesia, Libya, Angola, Iraq |
| Culture                             | Belgium, Netherlands, Malta, Austria, Germany, Estonia, Ireland, Czech Republic, Denmark, Luxembourg | Iraq, Venezuela, Laos, Iran, Cameroon, Rwanda, Yemen, Democratic Republic of the Congo, Libya, Sudan |
| International Peace and Security    | Egypt, Jordan, Tanzania, Lesotho, Uruguay, Togo, Benin, Paraguay, Nigeria, Ecuador | Portugal, Ukraine, Sudan, South Korea, Spain, Czech Republic, Azerbaijan, Hungary, Latvia, Lithuania |
| World Order                         | Germany, Austria, Netherlands, Ireland, Denmark, Malta, Norway, Sweden, United Kingdom, Switzerland | Angola, Cambodia, Qatar, Saudi Arabia, Rwanda, Singapore, United Arab Emirates, Vietnam, Iraq, Oman |
| Planet and Climate                  | Iceland, Canada, Sweden, Norway, Brazil, Australia, New Zealand, Congo, Uganda, France | Libya, Bangladesh, Belarus, Macedonia, Ukraine, Benin, Mauritius, Vietnam, Serbia, Zimbabwe |
| Prosperity and Equality             | Ireland, Switzerland, Finland, Sweden, Belgium, Ghana, Singapore, Netherlands, United Kingdom, Malaysia | Madagascar, India, Laos, Libya, Iraq, South Africa, Algeria, Brazil, Venezuela, Paraguay |
| Health and Wellbeing                | Spain, Netherlands, Belgium, Canada, Denmark, United Kingdom, United States of America, Sweden, Ireland, Switzerland | Lesotho, Republic of Congo, Venezuela, Zimbabwe, Namibia, Mongolia, Mozambique, Libya, Zambia, Cameroon |

**Figure 3.** Good Country Index: top ten and bottom ten countries
2. Relationships between indices
Relationships between the overall Good Country Index and other global indices were analyzed (figure 5) and the coefficients of correlations between all the components of the Good Country Index and corresponding global indices were calculated (figure 6). The Peace category and Global Peace Index pair is revealed to be unrelated as it lacks statistical significance. An alternative global index in the form of the Personal Safety category of the Social Progress Index (the same global index used to correlate with the overall Good Country Index) is used. Finally, only the overall Index is significantly correlated with all other global indices presented in this paper. Since all of the global indices are found to be correlated with the overall Good Country Index, they can be used in predictive analytics and spatial analysis.

In addition to these relationships, a significant positive correlation was found between the Happy Planet Index and the Health and Well-being category from the Good Country Index. The Happy Planet Index is also positively correlated with some other global indices such as the Social Progress Index and the Environmental Performance Index. The Ease of Doing Business Index is also significantly correlated with the overall Good Country Index and all its categories, except the International Peace and Security category, where the significant correlation is negative.

3. Rule induction
The Good Country Index was reclassified into quintile-based category (25 countries each) labelled as: ‘Most Good’, ‘More Good’, ‘Moderate’, ‘Less Good’, and ‘Least Good’. All other global indices were used as predictors. Numerous predictive analytics models were tested and the C5.0 model was the most optimal one with overall accuracy of more than 85%. The most important predictors have been identified, including the Global Innovation Index, Environmental Performance Index, region, Global Peace Index, and Global Creativity Index. Then the rules were obtained for ‘Most Good’ and ‘Least Good’ countries (figure 7).

4. Analyzing spatial clusters, outliers, and hot spots of countries
Spatial autocorrelation shows how geographical objects (for example, countries) are grouped together. If similar-value objects are more proximate in a geographical space, positive spatial autocorrelation exists, regardless of whether the similarity refers to low or high values. Cluster and outlier analysis are

### Table: Global Indices and Dataset Source

| Good Country Index Component | Global Index (& Dataset Source) |
|-----------------------------|---------------------------------|
| **Overall**                 | Social Progress Index (“SPI”) – by the Social Progress Imperative (URL: [http://www.socialprogressimperative.org/data/spi](http://www.socialprogressimperative.org/data/spi)) [2014 dataset] |
| Science and Technology      | Global Innovation Index (“GII”) – by INSEAD & World Intellectual Property Organization (URL: [https://www.globalinnovationindex.org](https://www.globalinnovationindex.org)) [2012 dataset] |
| Culture                     | Global Creativity Index (“GCI”) – Martin Prosperity Institute (URL: [http://martinprosperity.org/content/creativity-and-prosperity-the-global-creativity-index](http://martinprosperity.org/content/creativity-and-prosperity-the-global-creativity-index)) [2010 dataset] |
| International Peace and Security | Social Progress Index (Personal Safety category) (“SPI-PS”) – refer to Overall component |
| World Order                 | Human Development Index (“HDI”) – United Nations Development Programme (URL: [http://hdr.undp.org/en/content/human-development-index-hdi](http://hdr.undp.org/en/content/human-development-index-hdi)) [2010 dataset] |
| Planet and Climate          | Environmental Performance Index (“EPI”) – Yale University & Columbia University (URL: [http://epi.yale.edu/epi](http://epi.yale.edu/epi)) [2010 dataset] |
| Prosperity and Equality     | Global Opportunity Index (“GOI”) – Milken Institute (URL: [http://www.globalopportunityindex.org](http://www.globalopportunityindex.org)) [2011 dataset] |
| Health and Wellbeing        | Health Expenditure as % of Total GDP (“HealthExp”) – World Health Organisation (URL: [http://www.who.int/gho/health_financing/total_expenditure/en/](http://www.who.int/gho/health_financing/total_expenditure/en/)) [2010 dataset] |

**Figure 4.** Global indices
localized aspects of spatial autocorrelation, which indicate whether spatial clustering of either high or low values or the presence of outliers is more pronounced than one would expect in a random distribution. A cluster of low values corresponds mostly to ‘Most Good’ countries, while a cluster of high values corresponds mostly to ‘Least Good’ countries. Outliers are present where high values are surrounded mostly by low values, and vice versa. Figure 8 summarizes the findings of the cluster and outlier analysis.

| Good Country Index | Global Indices                          | No. of Countries | Correlation Coefficient (r) | Significance (2-tailed) (p) |
|--------------------|-----------------------------------------|------------------|----------------------------|-----------------------------|
| Overall            | Social Progress Index                    | 124              | -0.773 **                  | 0.0001                      |
|                    | Global Innovation Index                  | 121              | -0.732 **                  | 0.0001                      |
|                    | Global Creativity Index                  | 79               | -0.820 **                  | 0.0001                      |
|                    | Social Progress Index (Personal Safety category) | 114          | -0.608 **                  | 0.0001                      |
|                    | Human Development Index                  | 122              | -0.678 **                  | 0.0001                      |
|                    | Environmental Performance Index          | 124              | -0.642 **                  | 0.0001                      |
|                    | Global Opportunity Index                 | 91               | -0.694 **                  | 0.0001                      |
|                    | Health Expenditure as % of Total GDP     | 124              | -0.661 **                  | 0.0001                      |
|                    | Global Peace Index                       | 123              | 0.636 **                   | 0.0001                      |

Double asterisks (** ) indicate very significant (strong) correlation at the significance level 0.01

**Figure 5.** Overall Good Country Index vs. other global indices.

| Good Country Index | Global Indices                          | No. of Countries | Correlation Coefficient (r) | Significance (2-tailed) (p) |
|--------------------|-----------------------------------------|------------------|----------------------------|-----------------------------|
| Overall            | Social Progress Index                    | 124              | -0.773 **                  | 0.0001                      |
| Science            | Global Innovation Index                  | 121              | -0.757 **                  | 0.0001                      |
| Culture            | Global Creativity Index                  | 79               | -0.796 **                  | 0.0001                      |
| Peace              | Global Peace Index                       | 123              | -0.012                     | 0.896                       |
| World              | Human Development Index                  | 122              | -0.572 **                  | 0.0001                      |
| Planet             | Environmental Performance Index          | 124              | -0.416 **                  | 0.0001                      |
| Prosperity         | Global Opportunity Index                 | 91               | -0.457 **                  | 0.0001                      |
| Health             | Health Expenditure as % of Total GDP     | 124              | -0.361 **                  | 0.0001                      |

**Figure 6.** Good Country Index categories vs. corresponding global indices.
Hot spot analysis provides the spatial locations of high (hot spot) and low (cold spot) cluster values. Figure 9 displays the hot and cold spots, along with the locations of the four outlier countries. Hot spots are defined as clusters of significantly high values of the overall Good Country Index surrounded by high index values and cold spots are clusters of significantly low values of the overall Good Country Index surrounded by low index values. Hot spots (clusters of low index values) can be seen in the Middle East, India, Mongolia, and central parts of Africa. Low spots (clusters of high index values) are found in Scandinavia, Western and Central Europe.

| Category      | Ruleset                                                                                     | No. of Countries |
|---------------|--------------------------------------------------------------------------------------------|------------------|
| Most Good     | If $28.6 < \text{Global Innovation Index} \leq 55.2$ and Environment Performance Index $> 72.541$ and Social Progress Index (Personal Safety Score) $\leq 73.83$ then 75% confidence | 4                |
|               | If $\text{General Innovation index} > 55.2$ and Global Peace Index $\leq 1.942$ then 95.7% confidence | 23               |
| Least Good    | If $\text{Global Innovation Index} \leq 55.2$ then 81.2% confidence                         | 16               |
|               | If $28.6 < \text{Global Innovation Index} \leq 55.2$ and Environment Performance Index $= 72.541$ and Global Peace Index $\leq 1.637$ and Social Progress Index $= 49.46$ then 66.7% confidence | 3                |
|               | If $28.6 < \text{Global Innovation Index} \leq 55.2$ and Environment Performance Index $= 72.541$ and Global Peace Index $> 1.637$ and Region = East Asia and Pacific then 71.4% confidence | 7                |
|               | If $28.6 < \text{Global Innovation Index} \leq 55.2$ and Environmental Performance Index $= 72.541$ and Global Peace Index $> 1.637$ and Global Creativity Index $\leq 0.053$ and Region = Latin America and Caribbean then 50% confidence | 2                |
|               | If $28.6 < \text{Global Innovation Index} \leq 55.2$ and Environmental Performance Index $= 72.541$ and Global Peace Index $> 1.637$ and Region = Middle East and North Africa then 75% confidence | 4                |

**Figure 7.** Rules for “Most Good” and “Least Good” countries.

**Figure 8.** Cluster/outlier countries for the overall Good Country Index.

| Cluster/Outlier   | Countries                                                                                     |
|-------------------|-----------------------------------------------------------------------------------------------|
| High values       | Angola, Azerbaijan, Benin, Cambodia, China, Democratic Republic of the Congo, Iran, Iraq, Kuwait, Laos, Nigeria, Oman, Pakistan, Qatar, Republic of Congo, Rwanda, Sudan, Syria, Togo, Vietnam, Yemen, Zimbabwe |
| Low values        | Austria, Belgium, Germany, Denmark, Finland, France, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, New Zealand, Slovenia, Spain, Sweden, Switzerland, United Kingdom |
| High values       | Algeria                                                                                        |
| Low values        | Australia, Cyprus, Kenya                                                                        |
5. Grouping analysis
Spatially proximate groups with similar countries were identified. For 125 countries, eight groups were obtained by applying grouping analysis with a Delaunay triangulation spatial constraint. The entire world is covered by the system of triangles connecting all neighboring countries, even if they are islands.

The grouping analysis produced eight groups (Figure 10). Each of these groups can be described with a corresponding profile. For example, Group 1 – European Influence has all global indices with constantly high values, thus agreeing with the low mean overall score. It comprises many countries in Europe, particularly those in the south and east.

At least 40% of the top ten countries are members of Group 4 (‘The Best’) for all the components of the Good Country Index except the category Peace, which contains 50% of the top ten countries being members of Group 6 (‘Sub-Saharan Africa’). Countries from Group 4 score very highly in all global indices, while Group 6 countries are apparently ‘peaceful’ because they neither participate in arms exports, nor international conflicts, though internal strife is common.

6. Final remarks
The use of Geographic Information Systems helps to instill value in global indices by offering an avenue for mapping and spatial analysis. The Good Country Index may be treated as a key reference indicator for citizens and policy makers interested in the ‘goodness’ of countries, and in their levels of contribution towards the international good. When the Good Country Index is pooled together with other global indices, it allows stakeholders to identify the policy areas in which countries contribute to the global good. In general, the Good Country Index agrees with the use of other more specific global indices as proxies for its category components. Group profiling evaluates countries’ possible drivers for ‘goodness’, based on the diagnostic variable (global indices) characteristics. It is also possible to derive characteristics for countries in the top ten worst-performing tier using group profiling, although there is no single group which contains the majority of such countries.
Figure 10. Results of grouping analysis using the Good Country Index and other global indices.