5-2011

Development for the Past, Present, and Future: Defining and Measuring Sustainable Development

Max Cantor
University of Rhode Island, mcantor88@gmail.com

Development for the Past, Present, and Future:

Defining and Measuring Sustainable Development

Max Cantor
with Kristin Johnson

Table of Contents:

Abstract

In 1987, the United Nations released the Brundtland Report, which defined sustainable development as "development which meets the needs of the present without compromising the ability of future generations to meet their own needs." While this definition provides a relatively stable theoretical base from which development economists and political scientists can begin to tackle issues surrounding sustainable development, the inherently amorphous nature of this definition has also created a fair amount of ambiguity in both the economic literature surrounding sustainable development and the subsequent attempts by economists to measure it.

Historically, those interested in the science of development have typically relied on very specific and fundamental indicators and measurement tools (GDP, HDI, etc.) in their attempts to define and understand development trends around the world. In response to emerging interest in the relatively new idea of "sustainable development," a number of economists and political scientists have attempted to define and measure the popular term. However, due to the vague nature of the term itself and the multitude of opinions concerning its true meaning, the current economic literature concerning sustainable development is exceptionally hazy, lacking any real consensus on the exact definition of the term and more importantly: how best to measure it.

This project rectifies this gap in economic and political understanding surrounding sustainable development. The project funnels a fairly exhaustive review of contemporary literature on the topic into a comprehensive, polished definition of sustainable development. Based on this new definition, and with solid footholds in development theory, the project then creates a composite statistic that can be used to measure sustainable development on a national scale, in a generalizable and cross national context. The resulting index, the SDMI (*Sustainable Development Measurement Index*), integrates economic, social, and environmental components in its assessment of the sustainability of development in each nation where it is applied.

Lastly, through the juxtaposition of the SDMI with classic developmental measurement techniques like GDP and the Human Development index (displayed through the utilization of in-depth, intricate maps), this project illuminates an array of contemporarily relevant issues in the fields of economics and political science.

I. Introduction

On June 3rd 1992, 178 national governments came together in Rio de Janeiro to discuss what many considered to be the foremost issue facing the world's population. The massive *United Nations Conference on Environment and Development,* attended by 108 heads of state, 2,400 NGOs, and almost 10,000 journalists, later became known as "The Earth Summit," a testament to its unprecedented size and the scope of its concerns. The chief goal of the conference was to adopt a comprehensive blueprint of action that would outline the implementation of the paradigm of "sustainable development." The resulting plan of action, named simply "Agenda 21," symbolized a radical shift in both theories and policies related to growth and development (UNDSD, 1992). Its passionate preamble began as follows:

> "Humanity stands at a defining moment in history. We are confronted with a perpetuation of disparities between and within nations, a worsening of poverty, hunger, ill health and illiteracy, and the continuing deterioration of the ecosystems on which we depend for our well-being. However, integration of environment and development concerns and greater attention to them will lead to the fulfillment of basic needs, improved living standards for all, better protected and managed ecosystems and a safer, more prosperous future. No nation can achieve this on its own; but together we can - in a global partnership for sustainable development." (UNDSD, 1992)

The profound rhetoric of Agenda 21 seemed to speak of sustainable development as if it were the saving grace of all humanities' social ills, economic shortfalls, and issues of environmental degradation. Sustainable development, and the proposed global partnership of common purpose, had the appearance of a revolutionary new insight into international development and growth. But what exactly was this newfangled term being tossed around by some of the world's most influential leaders and economists? Many probably assumed that the term's express meaning was to be found in the Brundtland Report released five years previously, which defined sustainable development as "development which meets the needs of the present without compromising the ability of future generations to meet their own needs." However, even if this now infamous definition was in fact the interpretation intended by the drafters of Agenda 21, its inherently broad and ambiguous nature still left much room for uncertainty.

The Rio Conference and Agenda 21 are certainly not the only historical instances of the utilization of the term sustainable development as a representation of an immensely broad intended meaning. In fact, it is more representative of the norm than the exception. Herman Daly conceptualized this phenomenon is his book *Beyond Growth*, in which he explained that, "this term [sustainable development]—touted by many and institutionalized by some—is still dangerously vague…and although sustainable development is a term that everybody likes, …nobody is sure of what it means" (Daly, 1996). It was this premise of ambiguity and disagreement that revealed the need for the *Sustainable Development Measurement Index*. As Daly noted, the vague and misunderstood nature of the term sustainable development is a dangerous foundation upon which to build a set of national and international policies, and the hope in creating the SDMI was that this shaky foundation could be secured.

II. Definition

The chief goal of this project was to form a composite statistic that can be used to measure sustainable development on a national scale, in a generalizable and cross-national context. Due in large part to the equivocal nature of the term upon which my index was to be based, it became necessary to first clearly define and understand sustainable development in a theoretical, rather than empirical context. Like any scholarly undertaking, especially in the fields of development economics and political science, the logical first step in gaining a comprehensive understanding of sustainable development was to complete a fairly exhaustive review of the existing literature on the subject. The available literature was as varying in its definitions and comprehension of sustainable development as it was in its relevance and applicability to this endeavor. It is unnecessary in the context of this paper to provide an in-depth outline of the existing theories and definitions of sustainable development, all that must be understood is that there is little to no consensus as to what sustainable development truly means.

Defining sustainable development is a bit of a perplexing process. As has already been noted, "nobody is sure of what it means" (Daly, 1996). However, it does seem relatively clear that the most significant issues one must confront in attempting to define sustainable development are related to the intended scope and breadth of the definition. For the purposes of developing a composite index of sustainable development, it is imperative that the base definition be broad enough to encompass a host of issues and at the same time narrow enough in its scope to reflect the intricacies of sustainability. In past definitions, drafters have tended to err

to on the side of either overly broad or exceedingly narrow understandings of the term. Typically lodging themselves firmly in one end of the spectrum of breadth of meaning, economists and political scientists have tossed around the term sustainable development in a host of distinct contexts, utilizing it in representations of a number of varying phenomena.

The narrower definitions of the term tend to be used in the analysis of very specific aspects of human development. The vast majority of these narrow understandings of sustainable development have however, historically had one thing in common: they are extremely ecocentric in nature. That is to say that they are primarily focused on environmental maintenance and sustainability (*see* Moran, Wackernagel, Kitzes, Goldfinger, and Boutand (2007) and IUCN (1991)). Furthermore, many of these definitions focus so narrowly on issues of environmental sustainability that any subsequent measurement attempts or policy recommendations based on the definitions are inherently flawed due to their failures to recognize the host of issues relevant to developmental sustainability (*e.g.,* ESI (2005); EPI (2008); LPI (2010)). This is not to say that environmental management and development are not essential components of sustainable development, but rather that it is important not to let environmental issues overshadow broader issues of societal well-being and economic growth.

In returning to the other end of the theoretical spectrum, to the group of definitions characterized by their relatively broad nature, we again see consistent failures of past definitions in serving as the underlying theoretical base for a quantitative, empirical measurement tool. These failures, based in this case on the jumbled and vast groupings of indicators necessary to accurately represent the theoretical foundations of the definitions, have generally fallen short in both their comprehension of sustainable development as a term, and in their attempts to apply normative theories to varying and diverse circumstances. The list of indicators released by the United Nations Commission on Sustainable Development in response to Agenda 21 serves as a prime example of this phenomenon. The initial indicator list, released in 1996, was an attempt to represent the doctrines of the Rio Conference and the definition provided in the Brundtland Report. The indicator set contained 134 distinct indicators, ranging from the percentage of the population using solid fuels for cooking to the percentage of the population having paid bribes (UNDSD, 2005). The unavoidably far-reaching character of a set of 134 otherwise unrelated indicators made the overall indicator set almost unintelligible and practically useless, hence rendering the definition inadequate.

The variance in both the content addressed by the multitude of existing definitions and the discrepancies in levels of scope gave way to a number of important insights that were used in drafting my definition. The first of these insights was the understanding that the scope of my definition needed to be broad enough to invite consensus, while at the same time be circumscribed enough to directly address the core aspects of sustainable development. The second great insight spawned by a review of the existing literature was related to the multi-layered nature of sustainable development. It became apparent that general consensus existed in terms of the understanding that sustainable development involves multiple "baskets" of human and societal development, and furthermore that it was necessary to analyze these different development genres on an individual basis in order to formulate a complete, integrated definition and measurement index.

The prodigious meeting of the minds that was the Rio Conference examined sustainable development in terms of the relationship between economic development and environmental sustainability. This examination reflected an attempt by the United Nations to analyze and address the effects of current economic growth trends on the earth's finite environmental resources. Later research, most notably that of Gilbert, Stevenson, Girardet, and Stren (1996), added an additional component to the sustainable development puzzle: social development. Moving forward from the work of Gilbert, Stevenson, Girardet, and Stren (1996), developmental literature began increasingly to reflect the belief that sustainable development was comprised of three distinct baskets of development (social, environmental, and economic) (Mitlin, 1992). This fundamental theoretical foundation, of a three-tiered system of sustainable development, served as the basis for my definition and the eventual creation of the SDMI.

i. Sustainable Development Defined: *"Sustainable Development refers to social, economic, and environmental development that meets the needs of current society without compromising or limiting future development and growth."*

The general theoretical argument underlying this definition is premised on the theory that for a society to develop sustainably, it must provide for the development of social well-being and economic growth all within the confines of finite environmental resources. This definition attempts to convey the need for the enhancement of economic, social, and environmental development "which meets the needs of the present without compromising the ability of future generations to meet their own needs" (Brundtland Report, 1987). This definition recognizes the

importance of the viability of all three developmental systems in promoting the sustainability of overall development, and furthermore that each individual system reinforces the others. The success of one development system cannot come at the expense of another.

III. The Index

2008 Rank	Country	SDMI	2000	Country	SDMI	1995	Country	SDMI
1	Norway	22.9061648	1	Norway	20.69710966	1	Norway	20.71771484
2	Canada	19.41797905	2	Canada	18.6107784	2	Canada	17.90487698
3	UK	17.5186615	3	UK	16.45645496	3	UK	14.71703424
4	Germany	16.78167137	4	Germany	16.38966576	4	U.S.A	14.4369189
5	U.S.A.	15.58515676	5	U.S.A	15.53158037	5	Germany	13.89258519
6	Australia	15.24918493	6	Australia	15.02602633	6	Australia	13.58560455
7	Costa Rica	14.39967393	7	Japan	13.68556223	7	Japan	11.90716436
8	Japan	14.36511524	8	Costa Rica	13.51241241	8	Spain	10.92799986
9	Spain	13.92232552	9	Spain	12.87466147	9	Costa Rica	10.60084084
10	Hungary	13.5095945	10	Israel	12.72235063	10	Argentina	10.59264852
11	Israel	12.78900837	11	Argentina	11.28935834	11	Israel	9.610081769
12	Brazil	12.48733216	12	Brazil	10.48808974	12	Saudi Arabia	9.302280546
13	South Korea	11.9820951	13	Hungary	10.38139395	13	South Korea	8.097684624
14	Peru	10.9944459	14	South Korea	10.07257005	14	Hungary	7.817254853
15	Saudi Arabia	10.42408563	15	Peru	9.269611383	15	Peru	7.240248642
16	Mexico	9.979674764	16	Saudi Arabia	9.007347853	16	Nicaragua	7.139714475
17	Argentina	9.85867862	17	Nicaragua	8.760556286	17	Cuba	7.058013539
18	Nicaragua	9.423285137	18	Cuba	8.31528009	18	Brazil	6.433917806
19	Cuba	8.66678957	19	Mexico	7.25513080	19	Jamaica	6.04575248

		5			6			5
20	Jamaica	7.522236288	20	Jamaica	6.64297964	20	South Africa	4.971091794
21	China	6.853229806	21	China	6.23728006	21	China	4.755110738
22	Lebanon	4.882642487	22	Lebanon	4.724083292	22	Indonesia	4.015331352
23	Indonesia	4.873607129	23	Egypt	4.093638693	23	Mexico	3.92697176
24	Egypt	4.387429779	24	Morocco	3.895206225	24	Egypt	3.331106905
25	Morocco	4.232440544	25	South Africa	3.773054413	25	Lebanon	2.828593185
26	South Africa	4.005132094	26	Indonesia	2.914723752	26	Morocco	2.15830253
27	Rwanda	3.088012504	27	Ethiopia	1.427157975	27	Ethiopia	0.842210255
28	Nigeria	1.427176672	28	Rwanda	0.495624481	28	India	0
29	India	0.632198076	29	India	0	29	Rwanda	0
30	Ethiopia	0	30	Nigeria	0	30	Nigeria	0

The Sustainable Development Measurement Index (SDMI) is in essence an applied, quantitative reflection of my definition. The SDMI, like my definition, breaks sustainable development down into three distinct components: environmental, economic, and social development. These development genres are given meaning in two ways: first through a general theoretical explanation and definition, and second through a list of "orientors" (specific components of development that come together to define each of the three baskets of development). In moving forward with an explanation of the methodology utilized in creating the SDMI, it essential that I provide definitions for the three genres of development and outline their individual orientors.

i. **Social Development:** *Preservation and enhancement of a society's basic human needs, including most fundamentally health, education, and freedom from oppression.*
-Orientors:

a. Education
b. Health
c. Social Responsibility of the Government
d. Stability/Fragility

ii. **Economic Development**: *Economic growth that provides for the basic needs of the population and allows society to actively participate in the modern global marketplace.*
-Orientors:

a. Foreign Investment
b. Financial Volatility
c. Income
d. Government Revenue

iii. **Environmental Development:** *Management of the environment in a way that sustains both the future of the natural world and the future of human development.*
-Orientors:

a. Natural Resource Self-Reliance
b. Energy Sustainability
c. Domestic Resource Control
d. Land Use Potential
e. Carrying Capacity

The goal of the SDMI is to measure sustainable development in a multi-tiered system, which evaluates sustainable development from the ground up, creating a sort of development pyramid, with the specific indicators forming the foundation and the overall concept of sustainable development making up the apex. As the entire pyramid is only as strong as its foundation, it is imperative that the indicators making up the base of this development pyramid adequately reflect the orientors found in the next tier of the pyramid. It became clear as the index developed that the selection of indicators was as crucial as it was difficult, and that only by way of proper indicator selection would the data adequately represent sustainable development as a complete, integrated ideal. Therefore, the indicator set underlying the SDMI consists only of those indicators that are absolutely essential to the overall purpose of the index, so as to best convey the intended theoretical understanding behind each of the three development genres.

The word "indicator" is one of the many aspects of the English language that finds it roots in the Arabic vocabulary. In Arabic, indicator means "pointer," and in the case of the SDMI, *point* is exactly what the indicators do. Each quantitative indicator incorporated into the SDMI serves a distinct purpose in pointing to both its respective orientor and the overall theme of sustainability reflected in the definition. Every indicator in the SDMI provides a representation of a specific, non-overlapping concept essential to the baseline definition of sustainable development. A detailed explanation of each indicator and a justification for its inclusion in the SDMI is provided in the Indicator Codebook. *Infra,* at 14.

IV. Methodology

Now we move on to the methodology utilized in compiling the index and molding the vast horde of collected data into a simple, intelligible statistic. Albert Einstein once noted that people should "Make things as simple as possible, but not simpler," a theme that was prevalent throughout my approach to coding the SDMI. The process transpired as follows:

1. Data was collected for a 13-year period (1995-2008) for 30 countries. The selection of countries included is intended to represent a relative cross-section of the nations that make up the world, with deliberate discrepancies in socioeconomic status, location, regime type, size, and policy tendencies.

2. Individual indicators were selected to represent each of the orientors making up the three development baskets. Each indicator was then given specific weights according to its relative value to the overall orientor. This weighting process also served a dual purpose of normalizing the data values across the board. After weighting, in order to make the time series data comparable from year to year, threshold values were set for each indicator based on the best performing nation in that particular category.

3. Using multiplicative Excel formulas, a score was then calculated for each orientor (scores were on a 10 point scale). The scores were calculated through of process of attributing either a positive or negative value to each indicator in terms of its relation to the specific orientor (for example, Life Expectancy is positive where as Prevalence of HIV and Infant Mortality are negative).

4. The same coding methodology that was utilized in calculating each orientor score was then applied to the three overall development baskets (economic, social, environmental). Each orientor was assigned either a positive or negative value (e.g., for social development: health, education, and social responsibility were positive whereas stability was assigned a negative value). The total cumulative score for each development basket was then calculated, with the negative components subtracted from the sum total of the positively valued components. The cumulative scores were then normalized and placed on a 10-point scale.

5. The three scores, one for each of the development baskets, were simply added together in order to give a total score for sustainable development on a 0-30 scale (the results of which can be found above).

i. Scores by Development Genre:

2008 Rank	Country	Social Score	Rank	Country	Econ. Score	Rank	Country	Env. Score
1	UK	9.194634224	1	UK	7.877008526	1	Norway	6.700291147
2	Spain	9.129403159	2	Norway	7.13718212	2	Canada	4.371806353
3	Norway	9.068691538	3	Japan	7.021946439	3	Costa Rica	3.488496681
4	Germany	9.015018421	4	USA	7.018489529	4	Brazil	2.456154283
5	Canada	8.998167816	5	Israel	6.622612262	5	Nicaragua	2.333488351
6	Australia	8.644285192	6	Canada	6.04800488	6	Saudi Arabia	2.318462686
7	Costa Rica	8.585454399	7	Germany	5.926389779	7	Peru	2.063833365
8	USA	8.1897222	8	Australia	5.705481886	8	Germany	1.840263166
9	Japan	8.01244125	9	South Korea	5.345163445	9	Argentina	1.188584078
10	Argentina	7.828172571	10	Hungary	5.068982087	10	Nigeria	1.023383274
11	Hungary	7.721936214	11	Spain	4.876981467	11	Australia	0.899417851
12	South Korea	7.596639569	12	Cuba	4.005005946	12	Hungary	0.7186762
13	Israel	7.23327606	13	Jamaica	3.471726384	13	UK	0.447018746
14	Mexico	7.095233739	14	Brazil	3.369547309	14	Mexico	0.383768358
15	Brazil	6.661630569	15	South Africa	2.915647477	15	USA	0.376945028
16	Cuba	6.368675231	16	Peru	2.84097988	16	Indonesia	0.150966845
17	Peru	6.089632656	17	Morocco	2.810518641	17	Spain	-.0840591
18	Jamaica	5.83709849	18	Saudi	2.65615199	18	Ethiopia	-.12518557

		7		Arabia	9			
19	Saudi Arabia	5.449470946	19	Mexico	2.500672667	19	China	-.36524052
20	China	5.165755479	20	Costa Rica	2.325722846	20	Japan	-.66927245
21	Lebanon	5.119655354	21	Lebanon	2.296790198	21	Egypt	-.7632813
22	Nicaragua	4.81585127	22	Nicaragua	2.273945515	22	Rwanda	-.84026257
23	Egypt	4.039671722	23	China	2.052714853	23	South Africa	-.92989864
24	Indonesia	3.905975086	24	Rwanda	1.330624842	24	South Korea	-.95970791
25	Morocco	3.239056756	25	Nigeria	1.320976727	25	Israel	-1.06687994
26	Rwanda	2.597650235	26	India	1.235992061	26	Cuba	-1.7068916
27	South Africa	2.019383261	27	Egypt	1.111039397	27	Jamaica	-1.78658859
28	India	1.698686566	28	Argentina	0.841921971	28	Morocco	-1.81713485
29	Ethiopia	0.7847464	29	Indonesia	0.816665198	29	India	-2.30248055
30	Nigeria	-.91718332	30	Ethiopia	-1.230518	30	Lebanon	-2.53380306

V. Conclusion

This project and the resulting index is by no means the first attempt to define and measure sustainable development using empirical methods. Multiple theories and strategies have been employed in past measurement endeavors, ranging from composite statistics similar to the SDMI to single "omniscient" indicators. Typically however, these forays into the complex and hazy world of sustainable development have been conducted not as objective attempts to gain some broader understanding of development issues, but rather as tools to highlight particular policy objectives. The SDMI is a purely objective quantification instrument, the intent of which is to provide an accurate, sensible measurement of developmental sustainability in a broad, cross-national context. Subjective national affairs were not taken into account, and as the index was meant to apply to all states, regardless of system of government or socioeconomic status, specific domestic policy trends were not analyzed or considered.

In formulating the SDMI, I did not intend to make any sweeping generalizations regarding the best route to sustainable development. In fact, beyond the individual scores for

each development basket, the project provides no specific insights or recommendations regarding domestic or international policy. This is not to say that the SDMI has no use in policy design, in fact it's just the opposite. The SDMI has a multitude of possible applications in both domestic and international policy arenas. I however, am not the one to undertake these applications. The SDMI is a tool for the public, a quantitative measurement of developmental sustainability with far-reaching applications and implications. It is my hope that the index serves the necessary role of rectifying the gap in the economic and political literature surrounding the issue of sustainable development, and that it be utilized in a broad range of interdisciplinary contexts.

INDICATOR CODE BOOK

The indicator Code Book for the SDMI is organized first by development basket, followed by orientor, and finally by indicator. A brief description of the compilation methodology for the indicator and what role it plays in the SDMI is provided for every indicator along with a citation note reflecting the origin of the data.

- Note- all data was accessed in 2011

I. Social Development

i. Education:

1. *School enrollment, Secondary (%net)*- Net enrollment ratio is the ratio of children of official school age based on the International Standard Classification of Education 1997 who are enrolled in school to the population of the corresponding official school age (World Bank).
    - Secondary enrollment rates are included in the education orientor as a reflection of the percentage of the total population who possess the level of education necessary to actively participate in the global marketplace.
    - Data Sources- World Bank WDI (http://data.worldbank.org/), UNESCO Institute for Statistics (www.uis.unesco.org/ev.php?ID=2867_201&ID2=DO_TOPIC)

2. *Labor force, Female (% of total labor force)*- Female labor force as a percentage of the total shows the extent to which women are active in the labor force. Labor force comprises people ages 15 and older who meet the International Labour Organization's definition of the economically active population (World Bank).
    - Female labor participation rates are included in the education orientor as a reflection of both the level to which females are educated (a reflection of equality in education) and the level to which females are able to utilize their education in the marketplace. This indicator operates on the understanding that a nation which fails to educate 50% of its population, can hardly be said to be developing sustainably.
    - Data Source- World Bank WDI (http://data.worldbank.org/)

ii. Health:

1. *Life expectancy at birth, Total (years)*- Life expectancy at birth indicates the number of years a newborn infant would live if prevailing patterns of mortality at the time of its birth were to stay the same throughout its life (World Bank).

- Life expectancy rates are included in the health orientor as a fundamental indication of the health of a population and as a measure of the potential for future economic development.
- Data Source- World Bank WDI (http://data.worldbank.org/)

2. *Prevalence of HIV, Total (% of population ages 15-49)*- Prevalence of HIV refers to the percentage of people ages 15-49 who are infected with HIV (World Bank).

- HIV rate is included in the health orientor as both a measure of the health and sexual education of a given population and as a reflection of national health policy.
- Data Source- World Bank WDI (http://data.worldbank.org/)

3. *Mortality rate, Infant (per 1,000 live births)*- Infant mortality rate is the number of infants dying before reaching one year of age, per 1,000 live births in a given year (World Bank).

- Infant mortality rate is included in the health orientor as a broader measure of social well-being. Infant mortality rates are influenced by poverty, education, and availability of quality health care, as well as sanitation and nutrition factors, making it a good overall indicator of health in society (UNCSD, 2005).
- Data Source- World Bank WDI (http://data.worldbank.org/)

iii. Social Responsibility of Government:

1. *Health, Education, and Social Protection expenditures (% of total government expenditures)*- Specific expenditures as a percent of total government expenditures is the percentage of total government output spent on specific societal needs.

- Government expenditures were included as the only representation of the social responsibility orientor as an indication of national policy in the realm of government spending, and how much of the governments output is spent on ensuring the maintenance of social well-being.
- Data Source- IMF Government Finance Statistics (http://www.imf.org/external/pubs/ft/gfs/manual/gfs.htm)

iv. Stability/Fragility:

1. *State Fragility Index*- The State Fragility Index is a composite statistic developed by Monty G. Marshall, which measures governmental and societal stability on a 0-30 scale.

- The State Fragility Index was used as the sole measure of stability/fragility due to its comprehensive nature. The index adequately reflects the negative affects of poor stability levels on economic, social, and environmental maintenance and development.
- Data Source- Polity IV Project (http://www.systemicpeace.org/polity/polity4.htm)

II. Economic Development

i. Foreign Investment:

1. *Internet users (per 100 people)*- Internet users are people with access to the worldwide network (World Bank).

- Internet users (per 100 people) is included in the foreign investment orientor as a reflection of established infrastructure, a necessary prerequisite for foreign investment. Percentage of internet users is not only a reflection of the capabilities of citizens in participating in the global marketplace, but it is also a representation of the availability of electricity and web connectivity resources.
- Data Source- World Bank WDI (http://data.worldbank.org/)

2. *Foreign Direct Investment, Net inflows (% of GDP)*- Foreign direct investment are the net inflows of investment to acquire a lasting management interest (10 percent or more of voting stock) in an enterprise operating in an economy other than that of the investor. It is the sum of equity capital, reinvestment of earnings, other long-term capital, and short-term capital as shown in the balance of payments (World Bank).

- FDI inflows are included in the foreign investment orientor as a reflection of current levels of foreign investment and societal participation in international business.
- Data Source- World Bank WDI (http://data.worldbank.org/)

3. *Index of Economic Freedom*- The Index of Economic Freedom is a composite index released annually by the Heritage Foundation and the Wall Street Journal. The index covers 10 freedoms, ranging from fundamental rights to entrepreneurship; rating economic freedom levels on a 0-100 scale (Heritage Foundation).

- The Index of Economic Freedom is included in the foreign investment orientor as a measure of the levels to which foreign investors can expect domestic citizens to actively participate in their development projects. It is also quite useful in its representation of national economic policy.
- Data Source- Heritage Foundation (http://www.heritage.org/index/)

ii. Financial Volatility:

1. *Inflation, GDP deflator (annual %)*- Inflation as measured by the annual growth rate of the GDP implicit deflator shows the rate of price change in the economy as a whole. The GDP implicit deflator is the ratio of GDP in current local currency to GDP in constant local currency (World Bank).

- Inflation rates are included in the financial volatility orientor as a general measure of volatility and instability. In regards to both purchasing power parity and foreign investment, financial monetary volatility and inflation in particular, are extremely important measurements.
- Data Source- World Bank WDI (http://data.worldbank.org/)

iii. Income:

1. *GDP per capita (constant 2000 US$)*- GDP per capita is gross domestic product divided by midyear population. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in constant U.S. dollars (World Bank).

- A development index would not be a development index without a measure of income, and in my opinion GDP per capita (constant 2000 US$) is the most appropriate, normalized indicator available. Income provides perhaps the best overall snapshot of a national economy, and is necessary in any measure of economic development.

- Data Source- World Bank WDI (http://data.worldbank.org/)

iv. Government Revenue:

1. *Tax Revenue (% of total revenue)*- Tax revenue is all legitimately collected government taxes, total revenue represents the entirety of a national government's revenue stream.
    - The reason for including tax revenue as the sole indicator of government development was best captured by Jonshon and Rabinowitz (2007): "Taxation represents willingness on the part of the population (or enforcement ability on the part of the government) to transfer resources from private individuals to the government. This resource transfer is the bridge between politics and money; taxation demonstrates an endorsement or at least acceptance of a government by the population."
    - Data Source- IMF Government Finance Statistics (http://www.imf.org/external/pubs/ft/gfs/manual/gfs.htm)

III. Environmental Development

i. Natural Resource Self-Reliance:

1. *Food, Fuel, and Agricultural Raw Material imports as a percentage of total imports*- Food, Fuel, and Agricultural Raw Material imports (as defined by the world bank) as percentage of all commercial imports (wares).
    - Specific import percentages are included as a depiction of the level to which a nation relies on foreign imports to provide them with basic natural resources. It is in many ways a general measure of the sustainability of a nation's domestic resource holdings.
    - Data Source- World Bank WDI (http://data.worldbank.org/)

ii. Energy Sustainability:

1. *Alternative and nuclear energy (% of total energy use)*- Clean energy is noncarbohydrate energy that does not produce carbon dioxide when generated. It includes hydropower and nuclear, geothermal, and solar power, among others (World Bank).
    - This indicator is arguably the best available measure of sustainability of energy use. The reason for including the indicator, and energy sustainability in general, in environmental development is based on the assumption that in the future it will be advantageous for a nation's total energy use to consist of as little fossil fuel use as possible.
    - Data Source- World Bank WDI (http://data.worldbank.org/)

iii. Domestic Natural Resource Control:

1. T*errestrial protected areas (% of total surface area)*- Terrestrial protected areas are those officially documented by national authorities.
    - Environmental development, and sustainable development as a whole, depends on stable, healthy environment. This indicator represents the government's stance in regards to the protection of areas important to biodiversity, cultural heritage, and scientific research. It is a good general depiction of national policy in regards to preservation of the environment.
    - Data Source- World Bank WDI (http://data.worldbank.org/)

2. *Food, Fuel, and Agricultural Raw Material exports as a percentage of total exports*- Food, Fuel, and Agricultural Raw Material exports (as defined by the world bank) as percentage of all

commercial exports (wares).

- This group of indicators is included as part of the Domestic Resource Control orientor in order to provide insight into levels of over extraction. In other words, are domestic natural resources being extracted and exported at a sustainable pace.
- Data Source- World Bank WDI (http://data.worldbank.org/)

iv. Land Use Potential:

1. *Arable land (hectares per person)*- Arable land (hectares per person) includes land defined by the FAO as land under temporary crops (double-cropped areas are counted once), temporary meadows for mowing or for pasture, land under market or kitchen gardens, and land temporarily fallow. Land abandoned as a result of shifting cultivation is excluded (World Bank).

- The availability of arable land is of utmost importance to future development. The growth in national population levels has led to numerous questions concerning the intrinsic capabilities of nations' land in providing food for their respective populations. Additionally, the continued trend of urbanization has certainly had an adverse affect on the availability of agricultural land, leaving arable land figures in increasingly dire straits.
- Data Source- World Bank WDI (http://data.worldbank.org/)

2. Re*newable internal freshwater resources per capita (cubic meters)*- Renewable internal freshwater resources flows refer to internal renewable resources (internal river flows and groundwater from rainfall) in the country. Renewable internal freshwater resources per capita are calculated using the World Bank's population estimates (World Bank).

- The availability of freshwater, coupled with arable land per capita, represents the potential for sustained social well-being in the event of population growth. It is generally understood that the two most difficult resources to import are freshwater and arable land; these indicators reflect the possible implications of this difficulty.
- Data Source- World Bank World Bank WDI (http://data.worldbank.org/)

v. Carrying Capacity:

1a. *Population Density (people per sq. km. of land area)*- Population density is midyear population divided by land area in square kilometers. Population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship--except for refugees not permanently settled in the country of asylum, who are generally considered part of the population of their country of origin. Land area is a country's total area, excluding area under inland water bodies, national claims to continental shelf, and exclusive economic zones. In most cases the definition of inland water bodies includes major rivers and lakes (World Bank).

- Data Source- World Bank WDI (http://data.worldbank.org/)

1b. *Population growth (annual %)*- Annual population growth rate for year t is the exponential rate of growth of midyear population from year t-1 to t, expressed as a percentage. Population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship--except for refugees not permanently settled in the country of asylum, who are generally considered part of the population of the country of origin (World Bank).

- Population density and population growth, when taken together, are representative of the sustainability of current and future population levels. These two indicators are meant to represent the theory that due to finite environmental resource levels, states have a

maximum carrying capacity that cannot be exceeded if a nation hopes to develop sustainably. These two indicators, and the orientor they represent, are essential aspects of sustainable development, and are perhaps the foremost concern in moving forward with issues of sustainability.

- Data Source- World Bank WDI (http://data.worldbank.org/)

WORKS CITED

1. Environmental Sustainability Index. (2005). *Yale University*. Retrieved May 12, 2011, from http://www.yale.edu/esi/

2. Daly, H. E. (1996). *Beyond growth: the economics of sustainable development*. Boston: Beacon Press.

3. Data | The World Bank. (2011) *Data | The World Bank*. Retrieved May 12, 2011, from http://data.worldbank.org/

4. Environmental Performance Index 2010: Home. (2010). *Environmental Performance Index 2010: Home*. Retrieved May 12, 2011, from http://epi.yale.edu/Home

5. Expert Group Meeting on Indicators of Sustainable Development. (2005, December 13). *UNDSD*. Retrieved May 11, 2011, from docs.google.com/viewer?a=v&q=cache:ZAaCWr1fUAMJ:www.un.org/esa/sustdev/natlinfo/indicators/egmIndicators/crp1.pdf+un+center+for+sustainable+development+indicator+set&hl=en&gl=us&pid=bl&srcid=ADGEESglT2B6Rzjhoa8ylCTvK0THjDDkufOuUVDBV6Nu85N3rqQEyVBZDuKM469a

6. Gilbert., Stevenson., Girardet., & Stren. (1996). *Making cities work: the role of local authorities in the urban environment*. London: Earthscan.

7. IUCN's Caring for the Earth: A Strategy for Sustainable Living. (1991, January 1). *Earth Science data and services directory: Global Change Master Directory Web Site*. Retrieved May 12, 2011, from http://gcmd.nasa.gov/records/GCMD_IUCN_CARING.html

8. Index of Economic Freedom: Promoting Economic Opportunity and Prosperity | The Heritage Foundation. (2011) *Conservative Policy Research and Analysis | The Heritage Foundation*. Retrieved May 12, 2011, from http://www.heritage.org/index/

9. Living Planet Index 2010. (2010). *WWF - WWF*. Retrieved May 12, 2011, from http://wwf.panda.org/about_our_earth/all_publications/living_planet_report/

10. Moran., Wackernagel., Kitzes., Goldfinger., & Boutaud. (2007). Measuring Sustainable Development. *Ecological Economics*, *64*, 470-474.

11. Polity IV Project: Home Page. (2011). *Center for Systemic Peace: Home Page*. Retrieved May 12, 2011, from http://www.systemicpeace.org/polity/polity4.htm

12. Report of the World Commission on Environment and Development: Our Common Future (Brundtland Report). (1987, June 1). *UN Documents: Gathering a body of global agreements. Hyperlinked collection of more than 500 key United Nations documents*. Retrieved May 12, 2011, from http://www.un-documents.net/wced-ocf.htm

13. UNDSD :: Resources - Publications - Core Publications. (1992, September 4). *United Nations*. Retrieved May 12, 2011, from http://www.un.org/esa/dsd/agenda21/

14. UNESCO Institute for Statistics: UNESCO Institute for Statistics (3.14). (2011). *Welcome to the UIS Website*. Retrieved May 12, 2011, from http://www.uis.unesco.org/ev.php?ID=2867_201&ID2=DO_TOPIC

15. Mitlin, D. (1992). Sustainable Development: A Guide to the Literature. *Environment and Urbanization*, *4*(1), 111-124.

16. Johnson, Rabinowitz. (2007*). Relative Political Capacity: Empirical and Theoretical Underpinnings.* Claremont, California. October, 2007.