A critical analysis of global sustainability indices

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Abstract

Nation states of the world are driven by socio-economic imperatives that are rapidly degrading the natural resources that sustain life on Earth. This paradox has led to numerous initiatives to better understand and measure sustainability and sustainable development through indices. The primary objective of this research is to critically analyse the plethora of indices developed and used by institutions and organisations globally that have a role to play in measuring the sustainability and sustainable development of nation states, and distil the analysis into one integrated Sustainable Development Index (SDI) that compares all countries. A secondary objective is to review South Africa's response to measure sustainability and determine how well it performs compared to other nation states. A qualitative approach is used to review the literature in three steps, namely to consider the challenges of measuring what matters, to reflect on the response to govern and measure sustainability, and then to identify outcomes in terms of specific indices related to triple bottom line dimensions. The review considers the scope and level of integration of global indices as well as South Africa's response to measure sustainability. The analysis phase normalizes all the data to establish an integrated SDI for all countries, it then analyses and interprets the data to determine the variation and correlation between all the global indices, and then benchmarks countries and specifically South Africa. The review finds that twenty-one years after the Agenda 21 agreement at the Rio Earth Summit, no acceptable or established SDI has been developed and implemented by the United Nations, and the analysis develops two options for an integrated SDI at nation state level. In terms of both these SDI's South Africa performs poorly from a benchmarked perspective. From both the nation state and global indices perspectives, the appraisal of the single integrated SDI finds significant variations in the results, coupled with a wide range of correlation outcomes which distil into well correlated single integrated SDIs. The findings indicate that recent SDI developments are moving towards human wellbeing indicators, however although environmental priorities are considered, they play a secondary role. This "inconvenient truth" alludes to a "business as usual" approach as the policy makers of the world continue to focus on short-term socio-economic imperatives. Environmental thresholds and "limits to growth" considerations need to be fundamental aspects of all SDIs. This argument continues by factoring thresholds and priorities into the triple bottom line dimensions - a Sustainability Intelligence Quotient is developed from the integrated SDI, which suggests that only two countries meet the requirements.

Key words:
Sustainable development, sustainability measurement, sustainability indices, triple bottom line.

Declaration

I declare that this research report, apart from the contributions mentioned in the acknowledgements, is my own unaided work. It is being submitted for the Degree Master of Environmental Management at the North West University, Potchefstroom Campus. It has not been submitted before for any degree or examination at any other university.

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(Signature of candidate)

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Acronyms

AMSDE	Annual Meeting of Sustainable Development Experts
AU	African Union
BRICS	Brazil, Russia, India, China, South Africa
CSD	UN Commission on Sustainable Development
DEAT	Department of Environmental Affairs and Tourism
DPSIR	Driving Force-Pressure-State-Impact-Response model
GDP	Gross Domestic Product
GEO-5	Global Environmental Outlook
Gini	Income Gini coefficient
HDR	Human Development Report
IWR	Inclusive Wealth Report
JPOI	Johannesburg Plan of Implementation
NDP	National Development Plan
NEMA	National Environmental Management Act
NFA	National Footprint Accounts
NFSD	National Framework for Sustainable Development
NPC	National Planning Commission
NSDS	National Sustainable Development Strategy
NSSD 1	National Strategy for Sustainable Development 2011-2014
NSSD 2	National Strategy for Sustainable Development 2015-2020
OECD	Organisation for Economic Co-operation and Development
Rio+20	United Nations Conference on Sustainable Development in Rio de Janeiro 2012
RSA	Republic of South Africa
SD	Sustainable Development
SD21	Sustainable Development in the 21st Century
SDI	Sustainable Development Index/Indicators
SDS	Sustainable Development Strategy
SEEA	System of Environmental-Economic Accounts
Si_Q	Sustainability Intelligence Quotient
SoE	State of Environment
SOER	State of Environment Report
TBL	Triple Bottom Line
UN	United Nations
UN PGS	United Nations Secretary-General's High-level Panel on Global Sustainability
UNEP	United Nations Environment Programme
WoN	Wellbeing of Nations
WSSD	World Summit on Sustainable Development

Indices Acronyms

ANS	Adjusted Net Savings
C3Pi	Combined 3 Primary Index
ECOi	Economic Index
EcW	Economic Well-being
EF	Ecological Footprint
EneSI	Energy Sustainability Index
ENVi	Environment Index
EPI	Environmental Performance Index
ES	Environmental Sustainability
ESI	Environmental Sustainability Index
EW	Environmental Well-being
EWI	Ecosystem Wellbeing Index
GCI	Global Competitiveness Index
GCSDi	Global Composite Sustainable Development Index
GDP	Gross Domestic Product
GHNI	Gross National Happiness Index
Gini	Income Gini coefficient
GNI	Gross National Income
GPI	Genuine Progress Indicator
HPI	Happy Planet Index
HDI	Human Development Index
HW	Human Well-being
HWI	Human Wellbeing Index
IHDI	Inequality adjusted Human Development Index
ISEW	Index of Sustainable Economic Welfare
IWI	Inclusive Wealth Index
LPI	Living Planet Index
LPrI	Legatum Prosperity Index
QLI	Quality of Life Index
SDCi	Sustainable Development Composite Index
SOCi	Society Index
SSI	Sustainable Society Index
TBLi	Triple Bottom Line Index
WI	Wellbeing Index
YBLI	Your Better Life Index

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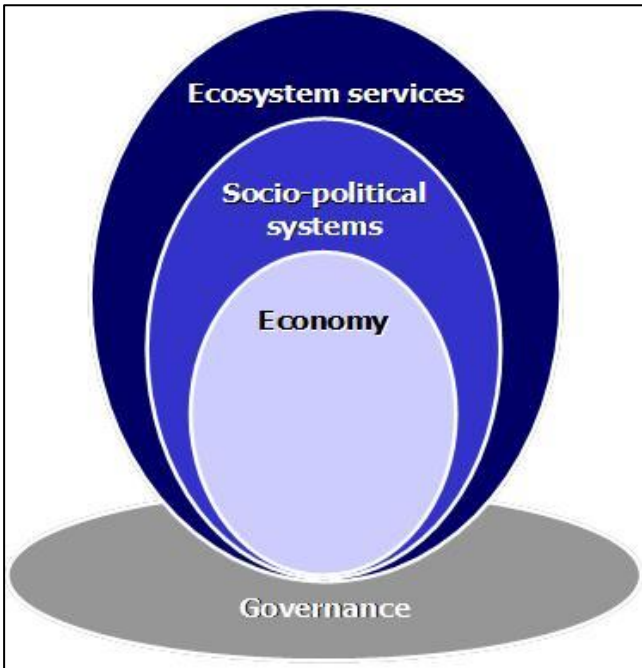
CHAPTER 1: INTRODUCTION

The context of this study should be seen against the background of ecological resources being used by humanity at increasingly unsustainable rates. World leaders are concerned with socio-economic growth imperatives that are exacerbating the problem. Essentially the success of countries is measured in terms of their Gross Domestic Product which is flawed in terms of measuring sustainability. Fundamentally, sustainability is where all human activity operates within the confines of the carrying capacity of the Earth's natural resources. The need to establish appropriate measurement techniques that incorporate these conflicting forces and lead to appropriate policy implementation, which considers future generations equally, is paramount.

The inspiring work of Meadows *et al.* (2004), who in 1972 set up a measuring instrument to simulate the limits to growth, motivated a better understanding of the consequences of infinite growth. Former Vice President of the United States Al Gore (Gore, 2006) poignantly refers to this as a planetary emergency in his book titled "An Inconvenient Truth", in which he questions why do leaders appear to ignore such clear warnings. Coupled with this Stiglitz *et al.* (2010), who argue that measurement matters, stimulated my research interest to explore the measurement of sustainability through global sustainability indices.

The initial reading included general literature on the concepts of "Sustainable Development" and the "Triple Bottom Line" (TBL) in an attempt to gain a better understanding of measuring the complex relationships between economic, social and environmental challenges. Of particular interest was the work of Prescott-Allen (2001), who set out to establish and measure the wellbeing of nations, which also provided motivation to explore further the topic of measuring progress and inquire how wellbeing should be understood. Moreover, Stiglitz *et al.* (2010), in "Mis-measuring our lives", looked at why GDP doesn't add up – this provocative study deals with measuring the things that matter most. Moran *et al.* (2008) measure sustainable development in a nation by nation study. They find that the overall trend over the past twenty five years in high-income countries is that improvements in their human development correspond with increases in their Ecological Footprints, presenting a movement away from sustainability. In terms of the South African understanding, the National Framework for Sustainable Development (NFSD – DEAT, 2008) presents a definition of sustainable development which acknowledges a systems approach to sustainability while the South African National Environment Outlook Report (DEAT, 2006) follows an indicator based approach towards measuring the state of our environment. However, the underlying debate across the above literature relates to the serious questions being asked about what and why we measure certain things – and what these results really tell us.

Within the framework of the study the following three concepts are constantly referred to and require some contextualisation. Figure 1 provides a systems approach to sustainability and serves as the reference point to discussion in the study. The general meaning of the concepts sustainability and sustainable development are described alongside the diagram. Elkington (1998:2) was the first to describe the concept of the Triple Bottom Line (TBL) and notes that "SustainAbility is developing the concept of the "triple bottom line" of sustainable development. Society depends on the economy – and the economy depends on the global ecosystem, whose health represents the ultimate bottom line". This description is clearly evident in the DEAT (2008) NFSD illustrated in Figure 1. Fittingly, the main title of the NFSD "People – Planet – Prosperity" fits neatly with Elkington who again, was the first to use the expression - People, Planet, Profit, or three Ps (Elkington, 2008).



The diagram represents a systems approach to sustainability because the economic system, socio-political system and ecosystem are seen as embedded within each other, and then integrated via the governance system that holds all the other systems together within a legitimate regulatory framework. Sustainability implies the continuous and mutually compatible integration of these systems over time; sustainable development means making sure that these systems remain mutually compatible as the key development challenges are met via specific actions and interventions to eradicate poverty and severe inequalities.

(Source: DEAT, 2008)

Figure 1: Sustainable Development Framework

Throughout the study the concept of the TBL is used to include the three dimensions of the Environment or Planet; Society or people; and Economy or Prosperity. For the sake of brevity the TBL concept is used in an integrative context with the concept of sustainability, as such the three dimensions are used to describe and develop a single integrated index (SDI) in chapter 4.

Moving on towards more focused literature, and to gain a better understanding of the need to measure global sustainability, the preamble of Agenda 21 (UN CED, 1992) is a good place to start. It considers the persuasive problems facing humanity and is aimed at "preparing the world for the challenges of the next century". This led to many initiatives aimed to establish

sustainability indicators and measure progress. Twenty years have since passed, and in July 2012 at Rio+20 (UN, 2012b), the United Nations General Assembly adopted the Resolution entitled the "Future we want". Over this period no single commonly agreed measurement method has been developed at nation state level to measure sustainability or sustainable development. Ideally such a single method should be the accepted benchmark which consistently and regularly updates an index for all nation states on a similar basis to that of the Gross Domestic Product (GDP) index. Furthermore, the literature review for this research revealed that there are publically available data on at least twenty different indices covering a range of sustainability and triple bottom line aspects for 191 countries (79 of which are reported on in all twenty indices). Dealing with and making sense of this wealth of information leads us to the problem statement for this research described in the next section.

The overall aim of the study, set out in section 1.2, is separated into a primary aim and a secondary aim. The scale of the primary aim of the study is evaluated at a global/macro level. The word global is used to clarify that this includes indices that measure all countries worldwide without any ring-fencing. Whilst the words nation states can be interpreted to mean lower than global scale it is used throughout the study to mean all countries. A challenge within the overall study aim is to consider the country South Africa in more detail, as a secondary aim. The two words nation states and the word countries have the same meaning and are used interchangeably.

In summary, the aim of the study is to develop an SDI that comprehensively includes the three dimensions of the TBL. The challenge is to derive an SDI that ensures that economic prosperity is achieved within a social system that provides justice, and that this is accomplished within the constraints of ecosystem services.

1.1 PROBLEM STATEMENT

Conceptualising and deciding what to measure in terms of sustainability elements and TBL understandings has been a continual challenge since the 1960s. For example in March 1968, twenty four years prior to the Earth Summit in Rio in 1992, US Presidential candidate Robert Kennedy (Kennedy, 1968) during his speech at an election rally made the following statement "The Gross National Product counts air pollution and cigarette advertising, and ambulances to clear our highways of carnage. It counts the destruction of Redwood and the loss of our natural wonder in chaotic sprawl. It counts napalm and counts nuclear war heads and armoured cars for the police to fight the riots in our cities and the television programs which glorify violence in order to sell toys to our children. Yet the gross national product does not allow for the health of our children, the quality of their education, or the joy of their play. It does not include the beauty

of our poetry or the strength of our marriages it measures everything in short, except that which makes life worthwhile."

Following on from the latter profound visionary speech and in an attempt to describe the problem statement for this research, two recent United Nations (UN) reports set the scene. In the first report, entitled "Resilient People, Resilient Planet: A future worth choosing (UN PGS, 2012), a number of recommendations are made towards dealing with the challenge of sustainable development. In particular Recommendation 39 states the following objective "To measure progress on sustainable development, a Sustainable Development Index (SDI) or set of indicators should be developed by 2014. To this end, the Secretary-General should appoint a technical task force, including relevant stakeholders." The following two statements also relate to Recommendation 39.

- "… the concept of sustainable development has not yet been incorporated into the mainstream national and international economic policy debate. Yet integrating environmental and social issues into economic decisions is vital to success."
- "In order to decouple production and consumption from natural resource use and environmental degradation, narrow concepts of GNP should be supplemented by indices or indicators which measure sustainable development."

The need for sustainability indices is expressed by the United Nations Commission on Sustainable Development (UNCSD 2012a) on their website where they state that "A highlight of RIO+20 is that the UN and major international players have agreed to develop new indicators leading us towards a more sustainable and fair world. But which indicators will be proposed?" The latter statement underpins the overall aim and sub-research questions described in the following section.

The second recent UN report prepared for Rio+20 in 2012, entitled "Back to our Common Future" (UN DESA, 2012), concludes with the following paragraph entitled 'Back to the future: Stockholm, 1972'.

"The last 40 years have seen repeated attempts at improving humanity's lot while preserving our common planet. At the Stockholm conference in 1972, India's Prime Minister Indira Gandhi said:

"It is clear that the environmental crisis which is confronting the world will profoundly alter the destiny of our planet. No one among us, whatever our status, strength or circumstance, can remain unaffected. The process of change will challenge current international policies. Will the

growing awareness of “one earth” and “one environment” guide us to the concept of “one humanity”? Will there be a more equitable sharing of environmental costs and greater international interest in the accelerated progress of the less developed world? Or will it remain confined to a narrow concern…?” As it was then, this challenge is worth our efforts now. Limited progress in the past does not have to deter us from trying again.”

The conflict between unlimited growth and improving humanity’s lot was addressed in 1972 by Meadows *et al.* (2004:x) who developed a World3 computer model which simulated the consequences of unrestricted growth on a finite planet. Pleading for significant change at all levels to avoid increasing the ecological footprint beyond the carrying capacity of planet Earth, they suggested there is a limit to growth. This needs to be measured at nation state level on a regular basis.

1.2 OVERALL RESEARCH AIM AND SUB-QUESTIONS

The primary aim is to analyse global sustainability related indices to determine whether a single integrated (Triple Bottom Line) index can be developed; the secondary aim is to asses South Africa’s sustainability understanding and determine its benchmarked performance.

A structural representation of the research problem is made up in the following three steps:

- Review the scope of global sustainability related indices that measure nation states, so as to discover the extent to which they integrate sustainability elements, in order to establish whether a single integrated SDI can be developed, and then
- appraise the single integrated SDI to ascertain the extent to which nation state global indices vary and correlate with one another in order to determine what a comparison of these two analyses may reveal. Then separately
- review South Africa’s response to measure sustainability and determine how well it performs compared to other nation states.

In order to achieve the overall aim the three steps have been reframed to answer the following six research questions:

1. What is the scope of the global indices in dealing with sustainability related dimensions of the TBL?
2. To what extent do the indices integrate sustainability elements?
3. How can a single integrated SDI index be derived from the global indices?
4. What is the extent of variation between the indices?

5. How well do the indices correlate?
6. What is South Africa's response to measure sustainability, and how well does it perform?

1.3 BRIEF OUTLINE OF REST OF STUDY

The basic design and methodologies are described in chapter three. The research study is based on the research design and methodologies set out in Mouton (2011) and Leedy and Ormond (2010).

The research process uses both qualitative and quantitative methods as follows:

- Review: Qualitative - Three sub-questions which essentially apply grounded theory characteristics, sub-questions 1, 2 and 6; and
- Analyse and interpret: Quantitative - Three sub-questions which apply content analysis and correlational research methodologies, sub-questions 3, 4 and 5.
- Synthesize the literature review data analysis and findings.

All the data used in the research study is available in the public domain.

Chapter four deals with the results of the data analysis to establish main trends and patterns in the data. Chapter five synthesises the literature review and data analysis and discusses the findings, and chapter six deals with the concluding comments and recommendations.

1.4 STRUCTURE OF THE DISSERTATION

Table 1 sets out the structure of the dissertation. The three steps making up the structural presentation of the problem are linked to their six corresponding research questions. The literature review is cross referenced to their three relevant questions and should be read alongside the Literature Review Framework illustrated in Figure 2. The table clearly relates the research steps to the sub-questions, overall research aim, methods and specific sections in the dissertation. The purpose of the table is to assist the reader to navigate the dissertation in relation to the six research questions.

Table 1: Structure of the dissertation – Navigation Index

Step	Sub-problems Chapter 1	RQ No.	Research questions (RQ) Chapter 1	Research question (RQ) linkage	Literature review Chapter 2 Refer Figure 2	Method and design Chapter 3	Data analysis Chapter 4	Findings Chapter 5
1	Review the scope of global sustainability related indices that measure nation states	1	What is the scope of the global indices in dealing with sustainability related dimensions of the TBL?	This RQ considers the Challenges and Response phases of the literature review set out in Figure 2	Sections 2.1 to 2.6	Review analyse and interpret data Section 3.1	Section 4.1	Section 5.1
	to discover the extent to which they integrate sustainability elements	2	To what extent do the indices integrate sustainability elements?	This RQ is derived from RQ1 and considers the Outcomes phase set out in Figure 2	Section 2.7 to 2.11	Review, tabulate and cross-reference data Section 3.2	Section 4.2	Section 5.2
	to establish whether a single integrated SDI can be developed	3	How can a single integrated SDI be derived from the global indices?	This RQ is derived from RQ2	Not applicable	Tabulate, normalize and analyse Section 3.3	Section 4.3	Section 5.3
2	Appraise the single integrated SDI to ascertain the extent to which nation state global indices vary	4	What is the extent of variations between the indices?	This RQ is derived from RQ3	Not applicable	Analyse and interpret Section 3.4	Section 4.4	Section 5.4
	and correlate with one another to determine what a comparison of these two analyses may reveal	5	How well do the indices correlate?	This RQ is derived from RQ3	Not applicable	Correlate and interpret Section 3.5	Section 4.5	Section 5.5
3	Review South Africa's response to measure sustainability and determine how well it performs compared to other nation states	6	What is South Africa's response to measure sustainability, and how well does it perform?	This RQ considers the Response phase of the literature review set out in Figure 2	Section 2.12	Review, analyse and interpret data Section 3.6	Section 4.6	Section 5.6

Overall Research Aim	**Conclusion and recommendations Chapter 6**	
The primary aim is to analyse global sustainability related indices to determine whether a single integrated (Triple Bottom Line) index can be developed; the secondary aim is to assess South Africa's sustainability understanding and determine its benchmarked performance		Interpret and synthesize six sub-questions

CHAPTER 2: LITERATURE REVIEW

This chapter considers the literature that relates to the overall research aim but in particular the following three research questions. Although this chapter provides an overview of the underlying literature, the synthesis of the literature to answer these questions is provided in the data analysis (sections 4.1, 4.2 and 4.6) and the findings (sections 5.1, 5.2 and 5.6).

1. What is the scope of the global indices in dealing with sustainability related dimensions of the TBL?
2. To what extent do the indices integrate sustainability elements?
6. What is South Africa's response to measure sustainability, and how well does it perform?

Figure 2, which illustrates a general three step approach and also defines the subsections, should be interpreted alongside Table 1 to navigate the study. Conceptually, the framework is a funnelled approach which indicates the directional flow from left to right. The broad issues of sustainability are considered first to set the scene as **Challenges**; this is channelled into how the challenges have been **Responded** to; thirdly the **Outcomes** reflect focussed evidence of measuring the sustainability performance of countries globally. This outcome flows into the data analysis:

- Phase I: Challenges (chapter 2, sections 2.1 to 2.3) – this is dealt with in three sub-sections. In order to finally arrive at the outcomes in phase III it is necessary to start with the broad meaning of sustainability (section 2.1), the context of sustainability is considered alongside socio-economic imperatives on the one hand and the conflicting environmental limits to growth on the other (section 2.2). Given that the study is a critical analysis, a fundamental component of it is to review measurement techniques, this leads to a separate review that considers the concept to measure what matters most (section 2.3);
- Phase II: Response (chapter 2, sections 2.4 to 2.6) – Sections 2.1 and 2.2 flow into how these sustainability issues have been responded to by global level institutions, that from a governance perspective can influence and guide policy change at nation state level (section 2.4). This effectively reviews the current situation leading up to Rio+20. Evidence of this high level influence and guidance then concentrates on literature measuring sustainable development (section 2.5). Here the link back to section 2.3 is established. This leads to a compatible yet separate review that considers the more recent developments that consider measuring well-being (section 2.6);
- Phase I and Phase II are reviewed with the objective of answering research question 1.

- Phase III: Outcomes (chapter 2, sections 2.7 to 2.11) - Sections 2.5 and 2.6 flow into a very focussed review with the purpose of determining specific evidence of indices that are utilised to measure nation states globally and universally. This review essentially deals with indices that talk to the elements of sustainability. The sustainability elements are transcribed into the three TBL dimensions as described in the introduction (chapter 1). Phase III is reviewed with the objective of answering research question 2.
- The result of this focussed phase III outcome review leads to the selection of indices that are used in the data analysis (section 4.3) to establish the development of a single integrated SDI in research question 3. Research questions 4 and 5 form part of the data analysis (sections 4.4 and 4.5), and are derived from an appraisal of the indices constituting research question 3. They seek to ascertain the extent to which nation state global indices vary and correlate with one another. Question 3 has an implied link to the phase III outcomes literature review, this link is made via question 2. Whilst not reflected on Figure 2 the literature review includes reference to data analysis methodologies in section 2.12 and a summary section (2.13) to conclude chapter 2.
- South Africa's response is dealt with separately in section 2.12. The objective of this review is to answer question 6.

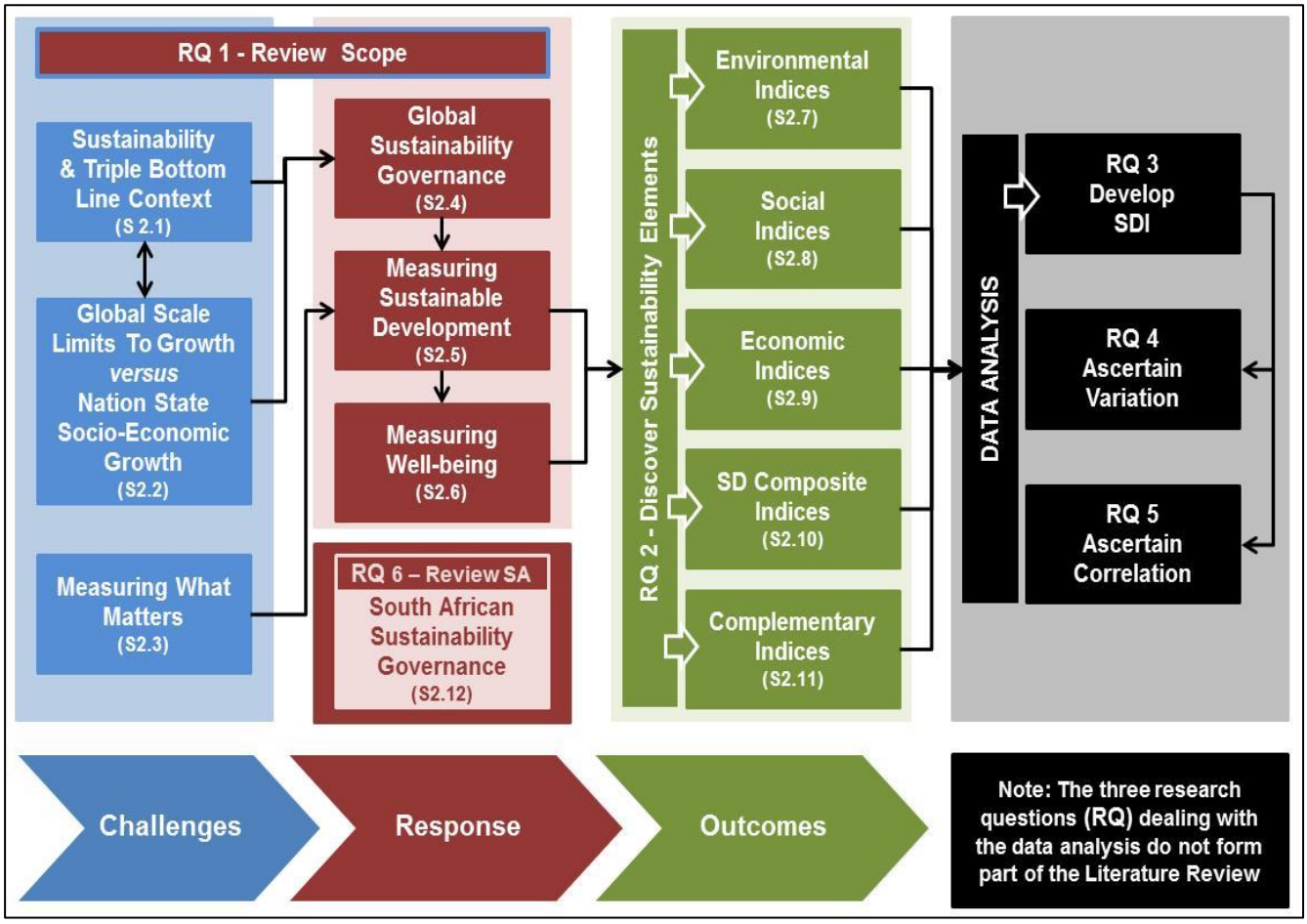


Figure 2: Literature review framework - Displaying flow linking to data analysis

CHALLENGES

With reference to Figure 2 and Table 1, the challenges to meeting the primary aim of the study, reviewed in section 2.1 to 2.3, comprise part of the review to answer research question 1.

2.1 SUSTAINABILITY CONTEXT

As mentioned in the introduction the concept of the TBL is used throughout the study to include the three dimensions of the Environment or Planet; Society or people; and Economy or Prosperity. The TBL concept is used in an integrative context with the concept of sustainability, refer Figure1. In order to establish an SDI the meaning sustainability and sustainable development are essential. The literature provides many different definitions of the two concepts with the Brundtland (1987) definition being widely used in both contexts. The purpose of this section is to provide a brief review of where the terms originated from and include some of the debate they have attracted. This intention is not to establish any specific definition, rather to set the scene for what is to follow in establishing an SDI.

Besides the discussion on the concepts of sustainability, sustainable development and the TBL described with Figure 1 it is practical to explore the background and history of these concepts. Satterthwaite (2006:9) notes that the concept of sustainable development was pioneered by Barbara Ward. Ward's concern for linking development with the environment is evident in the book she co-authored with Nobel Laureate; René Dubos titled "Only One Earth" (Ward and Dubos, 1972), which served as an unofficial report commissioned by the Secretary-General of the UN Conference on the Human Environment in Stockholm in 1972. The concept was central to the Brundtland (1987) report commissioned by the World Commission on Environment and Development (WCED). The report titled "Our Common Future" defined sustainable development as "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs", Brundtland (1987:43).

In Rio de Janeiro in 1992 the UN Conference on Environment and Development reaffirmed the Declaration of the UN Conference on the Human Environment held in Stockholm in 1972. With the goal of establishing "an equitable partnership between States, key sectors of society and people", this Rio declaration recognised "the integral and interdependent nature of Earth, our home". Principle 1 of this declaration proclaims "Human beings are at the centre of concerns for sustainable development. They are entitled to a healthy and productive life in harmony with nature", UNESCO (2013).

MacNeill (2012), chief architect and lead author of "Our Common Future", in presenting a master class at the Springtij festival on sustainability, refers to the confusion surrounding the

concept of sustainable development and notes two separate definitions that were debated. The first discussed the need to live within nature's limits where development was sustainable if "at a minimum it did not endanger the natural systems that support life on earth – the atmosphere, the waters, the soils, and the living beings" mentioning that current forms of development, back then, drew too heavily "on already overdrawn accounts of ecological capital". The second was concerned with consumption levels and noted that development was sustainable if it was "based on consumption standards that are within the bounds of the ecologically possible and to which all can reasonably aspire". Whilst stating that intergenerational equity is important, MacNeill (2012) regrets the turn of events that led to the exclusion of other important features in a viable definition and continues that "if we are to maintain a habitable planet for our species, we would have no choice but to begin to live within nature's limits keeping consumption at levels that are within the bounds of ecologically possible". The world economic systems were already, back in 1987, clearly interlocked with the Earth's ecological systems.

Porritt (2007:33), who defines sustainability as "the capacity for continuance into the long-term future", argues that the Brundtland (1987:43) definition is not the same as sustainability per se, and that it fails to convey the message that biophysical limits must not be eroded. Meadows *et al.* (2004:xiv) in "Limits to Growth" also argue that society is still trying to comprehend the concept of sustainability, and that the Brundtland definition remains ambiguous. Porritt (2007:33) maintains that sustainability is about being able to do things on an indefinite basis, whereas sustainable development is the process used to move towards sustainability. This relationship is also described in Figure 1. Elkington (1998:2) uses the term triple bottom line (TBL) to provide an alternative perspective on sustainability, whereby attention is given to economic prosperity, environmental quality and social justice.

The nested-egg approach taken by the NFSD (DEAT, 2008) in Figure1 is a valuable diagram in which to contextualise sustainability, sustainable development, the TBL and the three Ps (people planet, prosperity/profit). It is used by Prescott-Allen (2001) in determining the Wellbeing of Nations report where the metaphor of an Egg of Wellbeing is shown to emphasise that the ecosystem (the white of an egg) surrounds and supports people (the yolk). The NFSD goes one step further in that it places the economy inside the people aspect. This diagram highlights a hierarchy of one dimension being a function of another. Simply speaking, the economy is a function of the socio-political systems, which in turn are a function of ecosystem services. They all are integrated and require sound governance to be kept in balance. Another prominent diagram in which to frame sustainability is that of three interlocking circles each representing a TBL dimension, the middle area where they overlap being the area of sustainability. In discussing the various diagrams in which to understand the concept Adams

(2006) notes that the interlocking circles model is the one that has been adopted by the World Conservation Union.

2.2 GLOBAL LIMITS TO GROWTH VERSUS SOCIO-ECONOMIC GROWTH

In terms of the above mentioned discussion, an integral component of the concept of sustainability needs to include the ability of natural systems to maintain themselves indefinitely, within which life on earth will be supported. This brings the dilemma of limits to growth and socio-economic growth into perspective from a sustainability and sustainable development perspective. The review, therefore, seeks to broadly examine these two fundamental aspects.

2.2.1 Global Limits to Growth

The systems approach to sustainability (DEAT, 2008), Figure 1, and the concept of limits to growth (Meadows *et al.*, 2004), is dealt with by Senge (2006). A renowned systems thinker, he defines limits to growth as "a reinforcing (amplifying) process is set in motion to produce a desired result. It creates a spiral of success but also creates inadvertent secondary effects (manifested in a balancing process) which essentially slow down the process." (Senge, 2006:94). He proceeds to explain shifting the burden structures where an underlying problem generates symptoms that demand attention, but that the underlying problem is difficult to address so people "shift the burden" (Senge, 2006:103). These solutions only ameliorate the symptoms and leave the underlying problem unaltered. Senge (2006:111) notes that the underlying problem continues to worsen and the system loses its ability to solve the problem, essentially, a fundamental solution is required. Senge's (2006) theory is evidenced in Steffen *et al.* (2004) who deal with the change in human activity in recent times.

Steffen *et al.* (2004) deal with a systems thinking approach and note that "the Earth behaves as a single, inter-linked, self-regulating system", and continue that until very recent history, human activity has been an insignificant force within the Earth system dynamics. Human activity is now dominating the planet and stressing several biogeochemical cycles. The human changes to the Earth System are complex and interacting, affecting every component – land, coastal zone, atmosphere and oceans. The rapid growth of the human population and economic wealth over the past two centuries has led to significantly increased resource consumption. They illustrate in Figure 3 the cause and effect changes in two separate groups of twelve exponential growth graphs. The left-hand grouping indicates the increasing rates of change in human activity since the beginning of the industrial revolution, showing how the past 50 years have seen an unprecedented change in human history. The right-hand grouping indicates the ecological impact, where the dramatic increase of human activity has caused global-scale changes in the Earth System. Rockström *et al.* (2009), build on the work of Steffen *et al.* (2004) by identifying

and quantifying boundaries that must not be transgressed by human activity without causing unacceptable environmental change. Their approach defines preconditions for human development, and establishes that three of nine interlinked planetary boundaries have been exceeded. They determine that crossing certain biophysical thresholds might cause disastrous consequences for humanity.

Within this context - the effect of human activity on the Earth systems - one needs to take the past perspective of Steffen *et al.* (2004) and project it into the future. In the UN's Resilient People Resilient Planet report (UN PGS, 2012) the panel has a vision which recognises the impact of population growth increasing from 7 billion to almost 9 billion by 2040, this besides the drivers of unsustainable lifestyles, production and consumption patterns. By 2030 they see a world requiring 50 per cent more food, 45 per cent more energy and 30 per cent more water. Importantly, the panel notes that "Sustainable development has undoubtedly suffered a failure of political will". Coupled with this the UN's Back to Our Common Future report (UN DESA, 2012) refers to what can be expected from "business-as-usual". Not knowing what path the world will take over the next 40 years it notes that "big differences exist on the suggested policy solutions arising from different world views, grounded in different values". They refer to recent scenarios as "dynamics-as-usual" (DAU) which have future projections of the world to 2050. One can summarise these projections along the lines of the three TBL dimensions:

- People in 2050 - This DAU world would have high material consumption by 6 billion people who coexist with 3 billion in poverty. The 9.2 billion, 2.2 billion more than today, will be 70% urbanized which is an increase of 2.8 billion people.
- Economy by 2050 – Gross world product quadruples with Brazil, Russia, India, China and South Africa (BRICS) accounting for 40% of the world economy. Average GDP per capita will triple, but some vulnerable and poor countries will remain marginalised. Energy use will rise 80% with fossil fuels comprising 85% of the mix. A thirsty world will have significant increases in water demand which will limit expansion in the food and agriculture sectors.
- Nature and life support in 2050 – This DAU world would have two thirds of people living under water stress, increasingly polluted groundwater, deterioration of urban air pollution, continued deforestation and more land for agriculture, greenhouse gas emissions increasing 73% leading to 3-6 degree Celsius warming, unabated loss of biodiversity declining at least 10%, potential collapse of ocean fisheries, and phosphorous and nitrogen cycles exceeding safe thresholds.

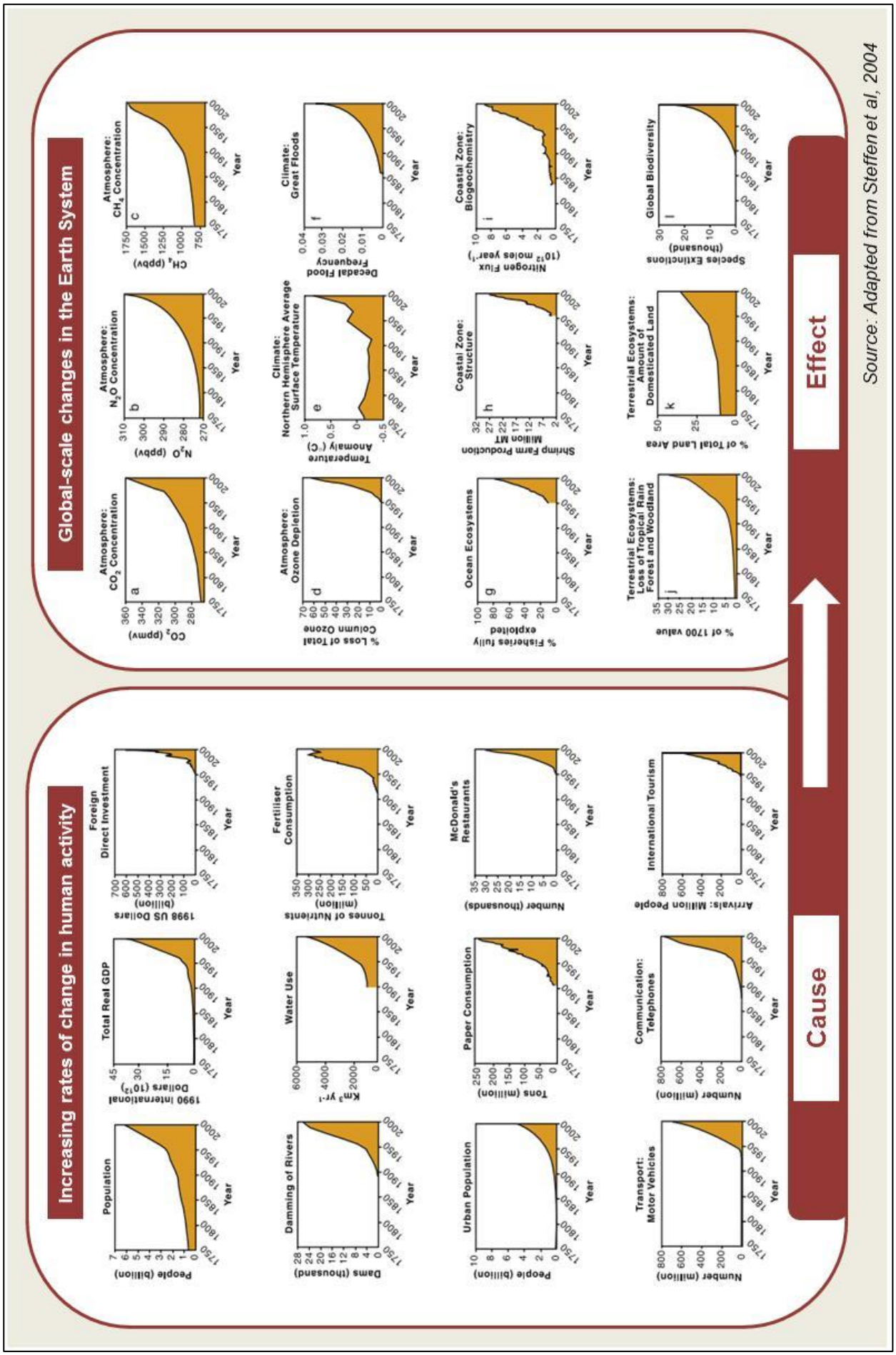


Figure 3: Human activity and Global change in the Earth System

2.2.2 Nation State Socio-Economic Growth

Literature that seeks to deal with the conflicting limits versus socio-economic growth dilemma includes Schneider *et al.* (2010) who discus the growing concept of sustainable degrowth, which requires the downscaling of production and consumption whilst enhancing ecological conditions. Also O'Niell (2012), who looks at the concept of a steady state economy and notes that clear indicators are required to determine whether degrowth is occurring, he analyses four indicator approaches including the GDP, ISEW, biophysical and social indicators, and a composite indicator. Nevertheless, degrowth remains a concept and this section encapsulates the crux of the problem statement – which needs to be measured.

2.3 MEASURING WHAT MATTERS

This section follows on from the dilemma reviewed in discussion in the previous section (2.2) and translates this into the relevance of being able to measure what matters the most. It begins with three reviews from the highest levels appealing for reliable measures of sustainability. Besides the original intentions of Agenda 21 (UN CED, 1992), to develop and implement sustainable development indicators, Rio+20 took place 20 years later with the same appeal for commitments to develop SDIs. In the interim period notable efforts to address the issue are reviewed.

2.3.1 The need for reliable Sustainable Development indicators

In a book that uses the same title as Ward and Dubos (1972) "Only One Earth" three prominent UN role players, including Maurice Strong who served as the Secretary-General to two relevant UN Conferences in Stockholm in 1972 and the Earth Summit in Rio 1992, show the continuing threat of current human activity to the planet and the challenges that we face forty years post the Stockholm Conference (Dodds *et al.*, 2012:123). They refer to serious concerns being expressed about the future of the UN Conference on Sustainable Development prior to the Johannesburg Summit in 2002 and the entire process of implementation. They quote from a paper by a previous (1999) chairman - Upton, just prior to the World Summit on Sustainable Development (WSSD) who tries to address why it is that with all the available evidence, governments were not willing to respond. In the third of three questions he asks "or is it all much more innocent – that we simply lack reliable measures of sustainability and a precise definition of the thresholds we dare not cross?"

Eight years on from the WSSD - Johannesburg Summit (UN, 2002) - a relevant and important report was published by Stiglitz *et al.* (2010). As a consequence of the global financial crisis in 2008, French President Nicolas Sarkozy commissioned Nobel winning economists Joseph Stiglitz and Amartya Sen, together with French economist Jean-Paul Fitoussi, to study whether Gross Domestic Product (GDP) is a reliable indicator of economic and social progress. The report, titled “Mis-measuring our lives; Why GDP doesn’t add up”, notes that in a progressively performance-oriented society, metrics matter and that what we measure affects what we do”.

Last year at Rio+20 one of the meetings was titled “Beyond GDP: toward social and environmental indicators” UNCSD (2012a). It refers to the limitations of many indicators that mask the irreversibility of pollution and deficiencies in inequality. Continuing that “Worse, they give us an illusion that it would be possible to compensate for severe deterioration of resources or climate change through for example financial, training or research and development investments”.

2.3.2 Agenda 21

Agenda 21 (UN CED, 1992) is the sustainable development action plan that was an outcome of the UN Conference on Environment and Development held in Rio de Janeiro in 1992. References to Sustainable Development Indicators (SDIs) are evident throughout the document. For example in section 4.11 it states “Consideration should also be given to the present concepts of economic growth and the need for new concepts of wealth and prosperity which allow higher standards of living through changed lifestyles and are less dependent on the Earth's finite resources and more in harmony with the Earth's carrying capacity. This should be reflected in the evolution of new systems of national accounts and other indicators of sustainable development.”

Section 8.6 of Agenda 21 notes that “Countries could develop systems for monitoring and evaluation of progress towards achieving sustainable development by adopting indicators that measure changes across economic, social and environmental dimensions”, and section 40.4 “Commonly used indicators such as the gross national product (GNP) and measurements of individual resource or pollution flows do not provide adequate indications of sustainability. Methods for assessing interactions between different sectoral environmental, demographic, social and developmental parameters are not sufficiently developed or applied. Indicators of sustainable development need to be developed to provide solid bases for decision-making at all levels and to contribute to a self-regulating sustainability of integrated environment and development systems”.

Commitments to develop and implement these sustainable development indicators remain strongly expressed by the wider community as seen in the recent Living Planet Report prepared for Rio+20 by the World Wide Fund (WWF, 2012a), Figure 4.



Figure 4: WWFs commitment to Sustainable Development Indicators

2.3.3 Measuring progress

A number of authors have addressed measuring progress. The work of Anand and Sen (1994), also Anand and Sen (2000), was instrumental in establishing a methodology of measuring societal progress, in turn moving away from the traditional indicators of development like the Gross National Product (GNP) per head. This methodology is applied in the annual Human Development Reports (HDR) which determines a Human Development Index (HDI) by nation. In 2011, the 21st version was published (UNDP, 2011).

Morse and Bell (2011) state that indicators are increasingly dominating our lives and are popular because they do the hard work of condensing complexity into single values that are easier to understand and act on. They argue the tyranny or fixation of certain measures like the dominance of one economic indicator, the GDP. They consider the Human Development Index (HDI) (UNDP, 2011) discussed above as a counter indicator to the GDP, and refer to attempts to re-design the basis of the GDP to include social and environmental concerns, thereby beyond a measure of monetary flow. They cite the Genuine Progress Indicator (GPI) as an example, where it keeps the fundamental emphasis on monetary flow but attempts to include components of quality of life and the environment, albeit that they are more difficult to measure. In their book

(Bell and Morse, 2008:41) they note that “the selection and measurement of Sustainability Indicators is hardly a fine art and is subject to many pressures, agendas and biases”, where a major criticism arises from encapsulating complex and diverse processes in a few simple measures.

Parris and Kates (2003) note that despite the definitional ambiguities over 500 efforts have been undertaken to develop quantitative indicators of sustainable development. They refer to the proponents differing on what emphasis needs to be sustained, what should be developed and how to link the environment, besides over what time period.

Looking specifically at ecological constraints Wackernagel and Rees (1996:1) state that there is widespread agreement that the Earth’s ecosystems cannot sustain current human activity and economic demands, and that weaknesses in the conventional model are increasingly apparent. They take the position that current denial will lead to greater pain in the future. Their Ecological Footprint method “accounts for the flows of energy and matter to and from any defined economy and converts these into the corresponding land/water area required from nature to support these flows”. The Ecological Footprint methodology is used by the World Wide Fund in their biennial Living Planet Reports (WWF, 2012). This report also provides the Living Planet Index (LPI) which shows a 30 per cent decline since 1970, and a global Ecological Footprint showing a continuing overconsumption trend that now equals 1.5 Planet Earths (2.7 gha over 1.8 gha). This is illustrated in Figure 5.

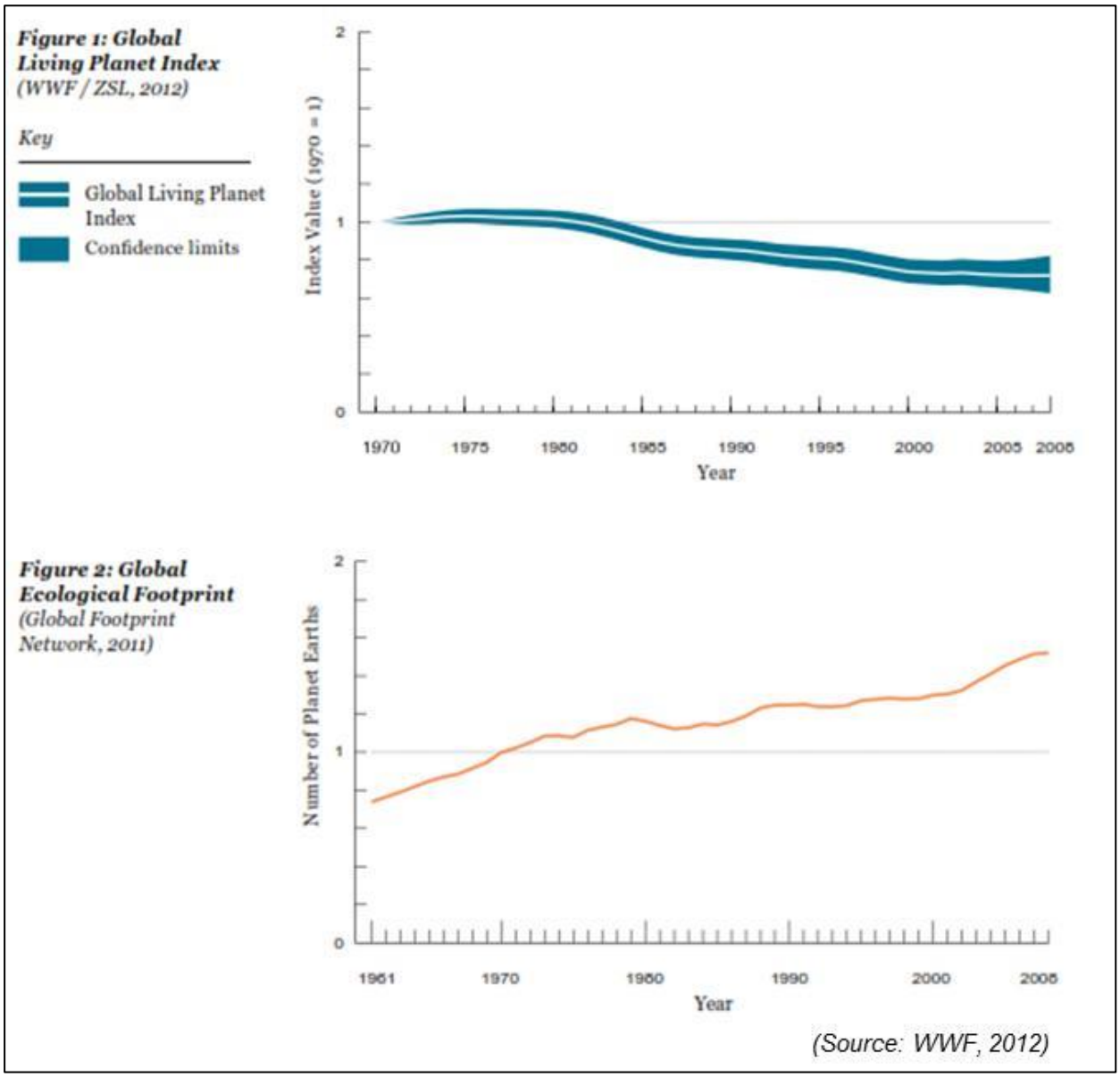


Figure 5: Living Planet Index and Global Ecological Footprint

Moran *et al.* (2008) argue that progress can be assessed by looking at both the HDI and Ecological Footprint dimensions, where the minimum standard for sustainable development means an HDI value exceeding 0.8 and the Ecological Footprint being less than the globally available biocapacity per person. They find that the trend in high income countries over the past twenty five years reveals that improvements in their HDIs correspond to a disproportionately larger increase in their Ecological Footprints. That is, "a movement away from sustainability". Figure 6, determined by Moran *et al.* (2008), illustrates the Global and regional trends in SD. It displays human development per the HDI (also see UNDP, 2010 and UNDP, 2011) on the y-axis versus resource demand (also see, Ewing *et al*. 2010, Wackernagel and Rees, 1996 and WWF, 2012) on the x-axis. The grey lines show trends from 1975 up to a point value in 2003. Noting that the suggested minimum criteria for SD are a HDI ≥ 0.8 and a footprint to biocapacity

ratio of ≤ 1.0 the matrix shows that no region resides in the top left shaded domain. In a similar diagram by country, only one resides in the SD quadrant.

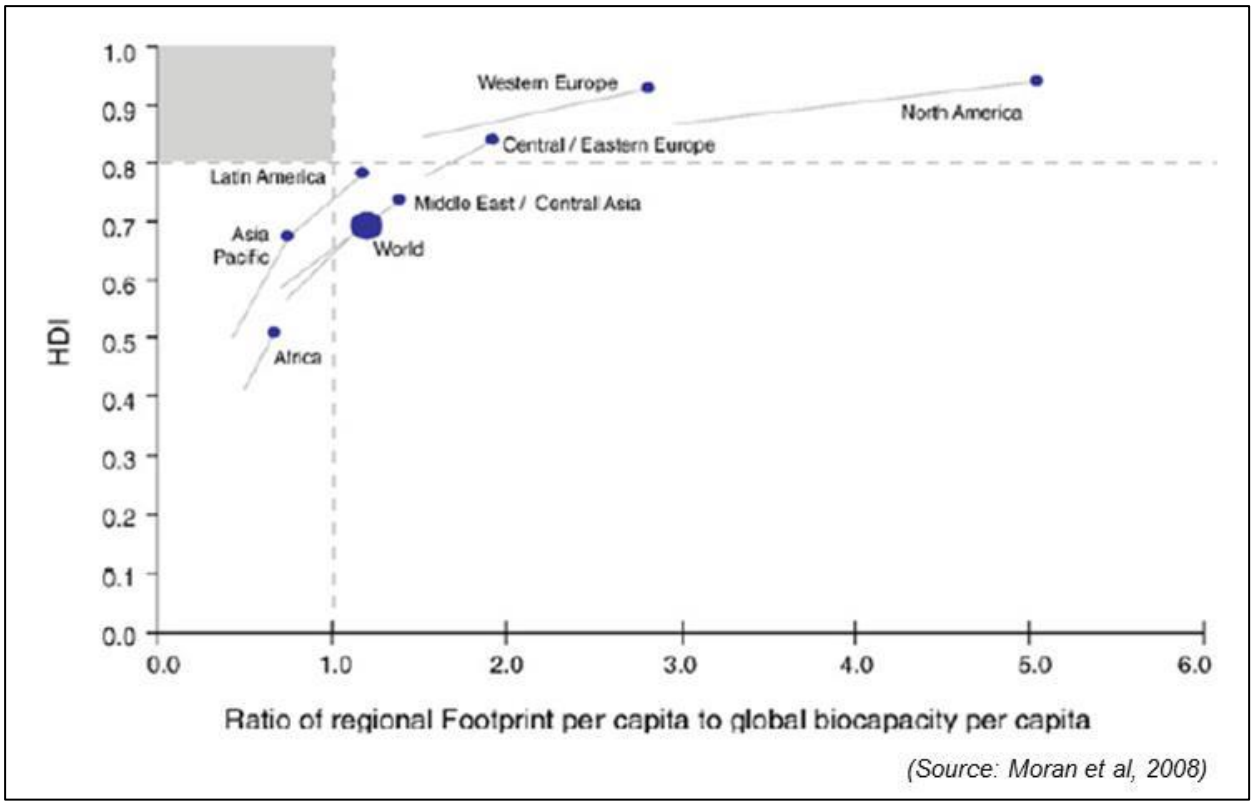


Figure 6: Global and regional trends in Sustainable Development

Borucke *et al.* (2013) document the latest method for estimating the EF and biocapacity of nations, which applies the National Footprint Accounts (NFA) methodology to over 200 countries. Noting that productivity of natural capital may become a limiting factor for human endeavour; they state that metrics tracking human demand on ecosystem services are needed. The theme to measure progress is also dealt with by Costanza *et al.* (2009) who discuss the inappropriate use of GDP as a measure of global human well-being and make a call for improved indicators that promote genuine sustainable development.

The Millennium Development Goals (MDGs) remains the primary framework for the development activities of the United Nations, and in September 2010, at the MDG Summit, world leaders developed a roadmap outlining the requirements to meet the 2015 deadline (UN, 2011). A report presenting an analysis of progress on the MDGs, published by the Overseas Development Institute (ODI, 2010), argues that it is important to measure progress in both absolute and relative terms and ranks countries accordingly.

This section has highlighted the appeal to establish SDIs that measure what matters most. The work of both Anand and Sen (2000) and Wackernagel and Rees (1996) bring the socio growth

and environmental degradation aspects into perspective, albeit separately. Moran *et al.* (200) then provides a useful matrix to bring the two aspects into focus, and shows the effect that human development is having on the environment. This argument is important in terms of the primary aim of the study to derive an SDI that ensures that economic prosperity is achieved within a social system that provides justice, and that this is accomplished within the constraints of ecosystem services.

RESPONSE

With reference to Figure 2 and Table 1, the response to meeting the primary aim of the study, reviewed in section 2.4 to 2.6, comprise part of the review to answer research question 1.

Having reviewed the sustainability context and growth constraints in phase I (challenges), to obtain the bigger picture influencing the development of SDFIs, evidence of how these issues are being addressed is sought. This starts with current events and literature that allude to SDIs. This leads into a review pursuing direct evidence measuring sustainable development and in particular SDIs in practice. This is followed by reviewing a topic that infers it is about sustainability, measuring wellbeing, to align this development with measuring sustainable development or the TBL.

2.4 GLOBAL SUSTAINABILITY GOVERNANCE – CURRENT SITUATION

Three recent inter-related initiatives, referring to sustainable development indicators and measurement, are relevant to responding to the current situation. In common with one another these reports have been drafted by United Nations (UN). Figure 1 illustrates the integration of a governance system that holds the TBL dimensions together and directs the frameworks in which they operate. This is synonymous with these recent initiatives from the UN calling for a renewed political deal that is concerned with non-sustainability trends. Whilst the UN is not accountable for the implementation of these initiatives they are proving high-level guidance and endevouring to influence change - governance is referred to within this context. Besides appealing to member countries to return “back to our common future”, the UN speaks to renewed commitments at RIO+20 aiming at “the future we want”, and then more specifically linking back to section 2.3 (measuring what matters), the UN provides an update on mega trends that it has been keeping track of to measure progress in terms of the TBL dimensions. Central to this link back to measuring what matters is Recommendation 39 (UN PGS, 2012).

The use of the word governance was to link to Figure 1 and also to encapsulate high level influential institutions that are providing guidance

2.4.1 Back to our common future

The main finding of a document prepared by the UN (UN DESA, 2012), titled the "Sustainable Development in the 21st Century" (SD21) project", states that "We need a renewed political deal". Prepared as a substantive contribution to the RIO+20 debate it looks at what has transpired since the Earth Summit in 1992, and provides a vision for the way forward to implement the sustainable development agenda in an integrated manner. They note that the 1992 Earth Summit political deal has never been fulfilled, and a new political deal is needed. With many of our problems being common, they state that no party can solve them independently from others and that common action is required. Furthermore, they note that the MDGs are not on track to be achieved in 2015. In questioning where we are today, they note three main trends since 1992:

- The record on development has been mixed;
- Global environmental problems have become more acute; and
- We are getting closer to global ecological limits.

The SD21 sets out four cross-cutting principles that are critical to building institutional frameworks that are fit for the challenges of sustainable development, namely:

- Improve governance;
- Improve measurement, monitoring and evaluation systems;
- Assess the roles of public and private actors; and
- Increase the resilience of human and natural systems.

In describing the second core principle - to measure progress and share data and knowledge - they note that capacities to measure, model, and monitor relevant dimensions of sustainability should be significantly strengthened. Noting that better accounting for natural capital is critical, they state that more resources need to be allocated to improving environmental monitoring and information systems.

2.4.2 The future we want

A press release by the UN Conference on Sustainable Development, Rio+20 (UN, 2012b), refers to the outcome document for Rio+20. Entitled "The Future We Want" the agreement,

made by 193 Member States of the United Nations, aims to advance action on sustainable development and provides a firm foundation for social, economic and environmental well-being. UN Secretary-General Ban Ki-moon said that Rio+20 affirmed fundamental principles, renewed essential commitments and provided a new direction – "Rio+20 has given us a solid platform to build on". Paragraph 33 of the January 2012 draft of "The Future We Want" document (UN, 2012) notes "We support the creation of an international knowledge-sharing platform to facilitate countries' green economy policy design and implementation", including paragraph 33(c) "a set of indicators to measure progress". Paragraph 43 recognises the importance of measuring global progress in terms of which States will be guided by a roadmap that contains indicative goals and timelines; paragraph 44(a) refers to establishing indicators and measures between 2012-2015. Reference to indicators continues in paragraphs 63, 109 and 111, which recognises the limitations of GDP as a measure of well-being. Curiously, these paragraphs do not appear in the final agreement (UN, 2012a) where the closest reference to the January 2012 drafts intentions (UN, 2012) are evident in paragraph 250, under the section Sustainable Development Goals, which states "We recognize that progress towards the achievement of the goals needs to be assessed and accompanied by targets and indicators, while taking into account different national circumstances, capacities and levels of development".

2.4.3 Keeping Track and Measuring Progress

Serving as an update to what has occurred since the Earth Summit in Rio in 1992, and also informing the Global Environmental Outlook (GEO-5) (UNEP, 2012); the UN released their "Keeping Track of Our Changing Environment" report (UNEP, 2011). Through numerically-based graphs the report shows major economic, environmental, social and technological trends. Noting that the world has changed over this twenty year period in unimaginable ways, it says that within the context of the "mega-trends" new environmental issues and phenomena have arisen. With the ever-increasing demand on natural resources they are being depleted and degraded sometimes before we realize it. They conclude that besides great advances in information and communication technologies we have not made the same breakthroughs in assessing the state of the environment. Improved monitoring and environmental data collection is essential at all levels in order to provide reliable and relevant decision-making information.

Regarded as the most authoritative assessment of the state, trends and outlook of the global environment, the GEO-5 (UNEP, 2012) shows that in far too many areas, environmental change is pushing the planet towards tipping points. Using a scientific analysis, to determine that the world requires an urgent change in its development direction following the 1992 Earth Summit, it highlights approaches, responses and policy options. A companion report to the GEO-5 leading up to Rio+20 is the "Measuring Progress: Environmental Goals and Gaps" report (UNEP,

2012a). Figure 7 provides the report's conclusion and aptly articulates the intentions of this research project.

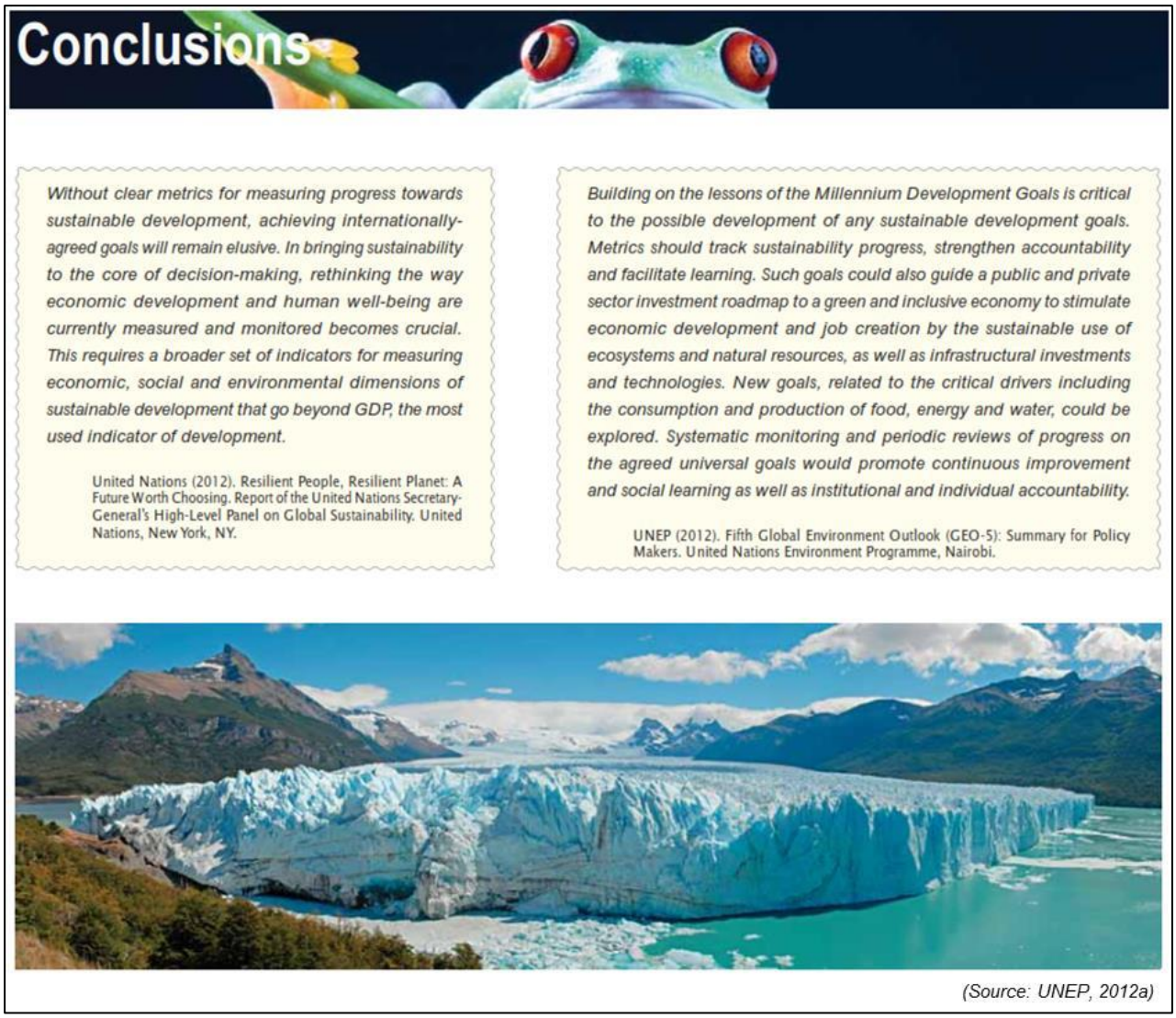


Figure 7: GEO-5 Summary for Policy Makers

In support of both the GEO-5 (UNEP, 2012) and Measuring Progress (UNEP, 2011) reports another report was drafted for the UN High-level Panel on Global Sustainability (UN PGS, 2012), the report – chaired by Presidents Tarja Halonen of Finland and Jacob Zuma of South Africa - makes 56 recommendations for a sustainable planet, just society and growing economy. Recommendation 39 is made up from four paragraphs (198-201) dealing with "establishing a common framework for measuring progress". As illustrated in Figure 8 the report notes that a Sustainable Development Index, highlighted by the red circle, should be developed by 2014 and that a technical task force should be appointed accordingly. The red arrow emphasises the need to move away from economic indicators being the proxy for measuring societal progress.

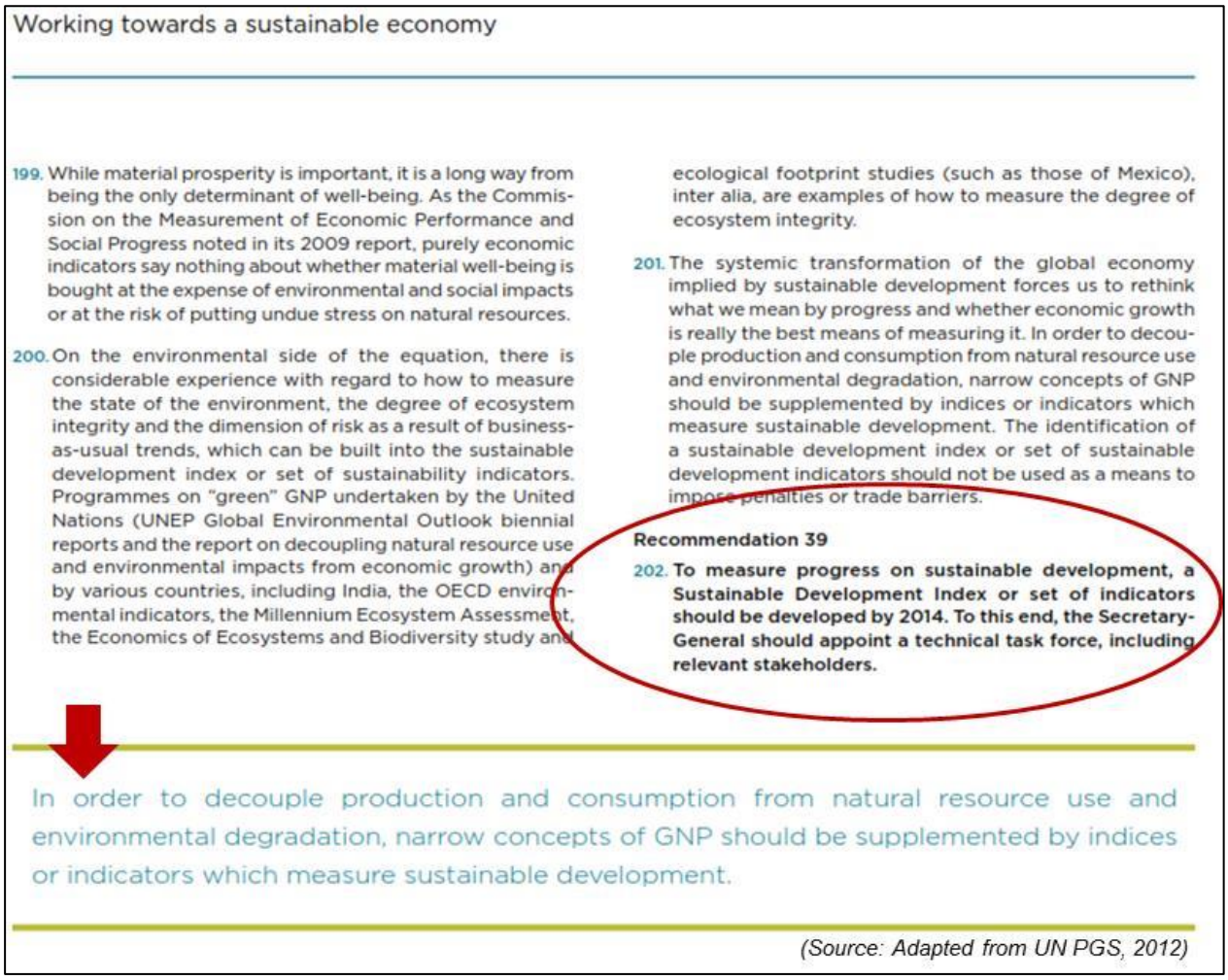


Figure 8: Development of a Sustainable Development Index by 2014

The UN SD (2012) notes that a critical lesson from Agenda 21 (UN CED, 1992) is that integrated policy decision-making is fundamental. Describing that the System of Environmental-Economic Accounts (SEEA) evolved out of Chapter 8 of Agenda 21, they state that the SEEA provides an international framework that reverses the historical 'information silo' approach to statistics, and responds to the demand for integrated policy making with directly relevant indicators. Figure 9 describes the SEEA measurement framework.

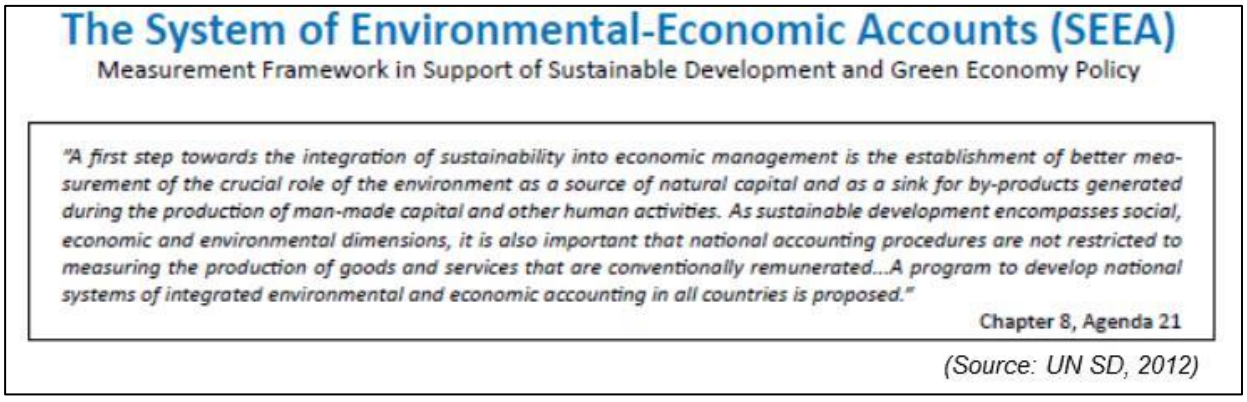


Figure 9: System of Environmental-Economic Accounts

2.4.4 Driving Force-Pressure-State-Impact-Response model

Shah (2000) refers to the third session of the Commission on Sustainable Development (CSD) approving a list of 134 indicators organized into the Driving Force-State-Response (DSR) framework, which cut across the four Agenda 21 categories – Social, Economic, Environmental and Institutional. This DSR model is expanded into the Driving Force-Pressure-State-Impact-Response (DPSIR) model. Swanson *et al*. (2011) describe the usefulness of the DPSIR model which is used for all GEO reports. A South African derivative of the model, presented by Retief (2010), is shown in Figure 10.

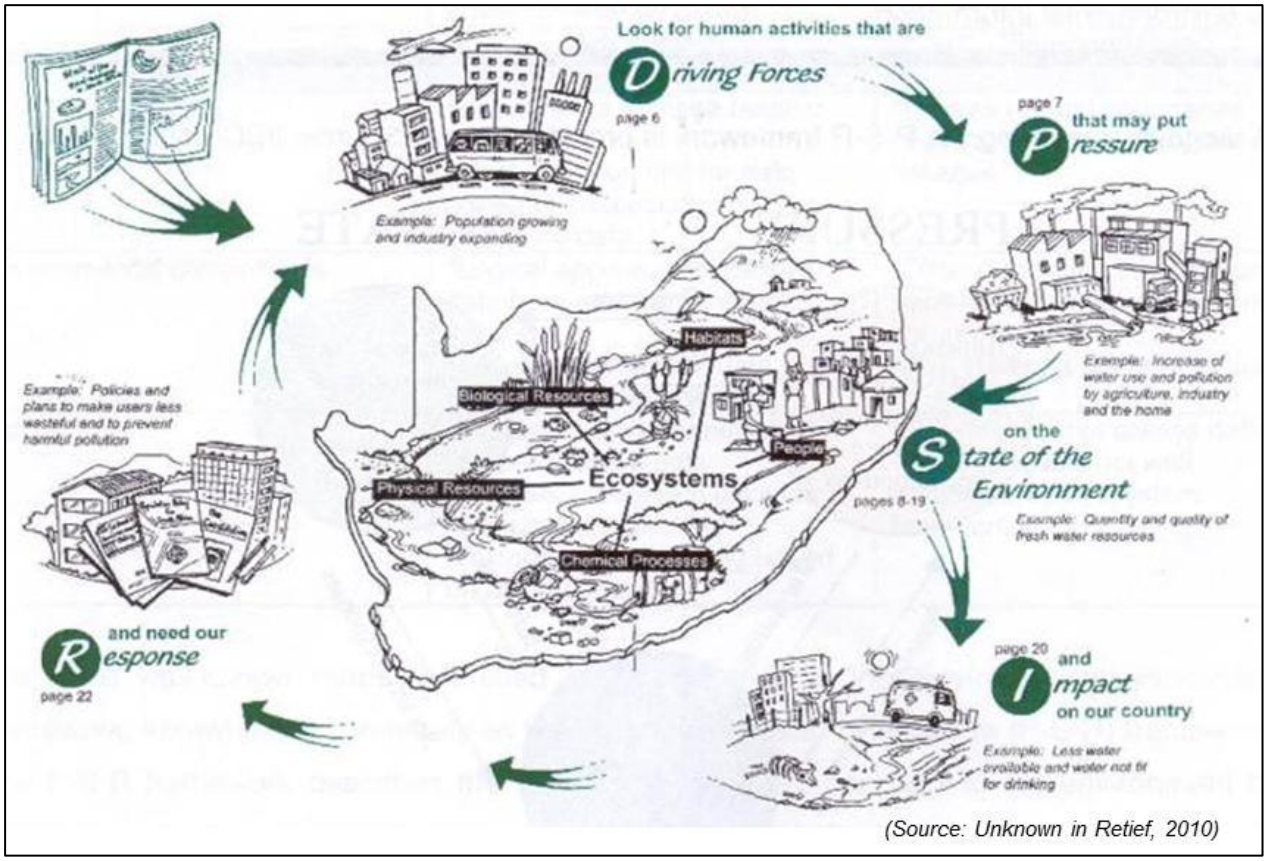


Figure 10: Driving Force-Pressure-State-Impact-Response model

Following the review of these high-level UN initiatives, attention is directed at specific evidence of initiatives actually measure sustainability.

2.5 MEASURING SUSTAINABLE DEVELOPMENT

This section links the previous mentioned reviews in sections 2.3 (measuring what matters) and section 2.4. It reviews two separate UN influenced initiatives to develop SDIs, and then reviews the role various organisations have played in the establishment of SDIs.

A joint working group between UN Economic Commission for Europe (UNECE), the Organization for Economic Co-operation and Development (OECD) and the statistical office of the European Communities (Eurostat) was mandated to propose a small set of Sustainable Development Indicators (SDIs) that could be used for comparing countries (UNECE, OECD and Eurostat, 2009). They note that while economic wealth is an important measure of sustainable development from a capital perspective, it must be supplemented to reflect the well-being effects of capital that cannot be captured in a market-based monetary measure. From this capital perspective they regard both stock and flow indicators to be important, and note that natural capital contains critical assets that are essential for basic life support. They establish two domains, foundational well-being to measure stocks and flows essential to the well-being of society, and economic well-being derived from market activity, refer Table 2 for their SDI set.

Table 2: Proposed small set of Sustainable Development Indicators

Indicator domain	Stock Indicators	Flow Indicators
Foundational well-being	Health-adjusted life expectancy	Changes in age-specific mortality and morbidity (place holder)
	Percentage of population with post-secondary education	Enrolment in post-secondary education
	Temperature deviations from norms	Greenhouse gas emissions
	Ground-level ozone and fine particulate concentrations	Smog-forming pollutant emissions
	Quality-adjusted water availability	Nutrient loadings to water bodies
	Fragmentation of natural habitats	Conversion of natural habitats to other uses
Economic well-being	Real *per capita* net foreign financial asset holdings	Real *per capita* investment in foreign financial assets
	Real *per capita* produced capital	Real *per capita* net investment in produced capital
	Real *per capita* human capital	Real *per capita* net investment in human capital
	Real *per capita* natural capital	Real *per capita* net depletion of natural capital
	Reserves of energy resources	Depletion of energy resources
	Reserves of mineral resources	Depletion of mineral resources
	Timber resource stocks	Depletion of timber resources
	Marine resource stocks	Depletion of marine resources

(Source: UNECE, OECD and Eurostat, 2009)

In the summary report prepared for the European statisticians the following diagram (Figure 11) is used to show how capital, welfare and well-being are related (UN DESA, 2011). It reflects the same, albeit transposed, philosophy of the NFSD (DEAT, 2008) diagram in Figure 1.

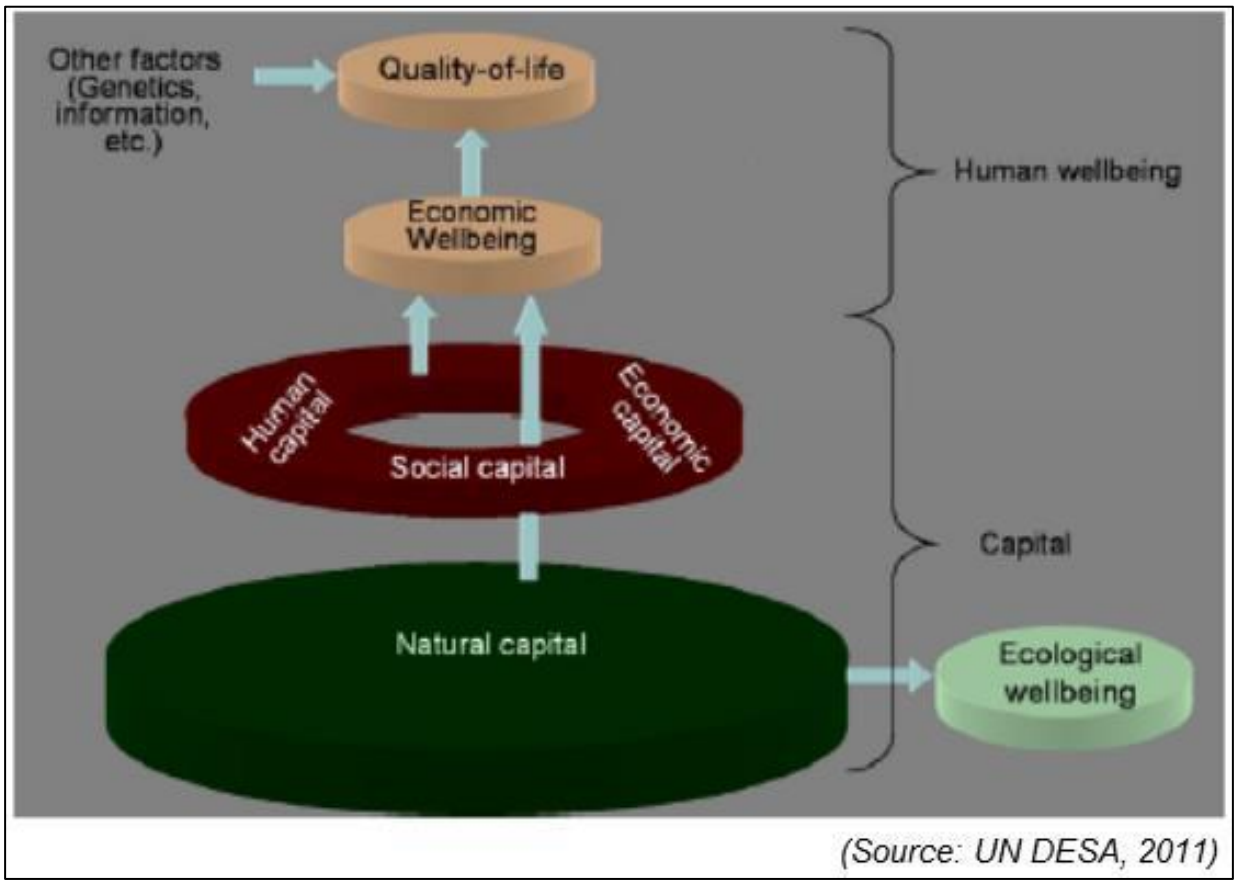


Figure 11: Human well-being and its relation to capital

In the third edition of their "Indicators of Sustainable Development: Guidelines and Methodologies" the UN note that their newly revised set of indicators contain a core set of 50 indicators, which form part of a larger set of 96 indicators of sustainable development (UN DESA, 2007). The indicators are contained in fourteen themes. A useful table within the report provides a cross reference to the Agenda 21 chapters, the MDG indicators, and the JPOI chapters. Noting that indicators are tools for measuring sustainable development processes at the national level, they provide a definition for a National Sustainable Development Strategy (NSDS) as "a coordinated, participatory and iterative process of thoughts and actions to achieve economic, environmental and social objectives in a balanced and integrative manner."

The literature review established that there are numerous other reports and initiatives that are grappling with this topic. A memorandum prepared in Sofia Bulgaria, by the Directors General of the National Statistical Institutes (DGINS, 2010), reports on the growing political and societal demand to measure sustainable development and well-being in a more comprehensive way.

Shortly before the WSSD Hales and Prescott-Allen (2002) noted that the essential link between responsibility and accountability is a valid and reliable measurement of change over time, and that this link was not forged at the Rio Earth Summit. Despite volumes of data, the performance of governments and society in the pursuit of sustainability has not been systematically or transparently reported. Hardi and Zdan (1997) refer to the ten Bellagio principles for assessment as a useful measurement method. In a paper prepared for the UNDSD experts meeting on SDIs in 2005, Pintér *et al.* (2005) state that SDIs have the potential to turn the concept of sustainability into action, and provide a review of key achievements and emerging trends and make suggestions for a way forward. The Secretariat of the UNCSD (2012) released a RIO 2012 Issues Brief (no.6) discussing current ideas on Sustainable Development Goals (SDGs) and indicators, providing information on the measurement of SD.

van de Kerk and Manual (2008) provide three insightful contributions to this debate. They search for a satisfactory set of indicators to measure the level of sustainability of a country, and find that none of the existing indexes meet the needs completely. In response they developed a new SDI, the Sustainable Society Index (SSI) which they apply to 150 countries. They also do a "short survey of relevant indexes and sets of indicators concerning development toward sustainability" for the annual meeting of sustainable development experts (AMSDE). Besides making a number of recommendations they conclude that GDP is an inadequate measure of economic progress, and an adequate index and or set of indicators is required to measure a country's wellbeing (van de Kerk and Manual, 2010). The third document questions whether human wellbeing is on a collision course with environmental wellbeing? In this case, for 151 countries, van de Kerk and Manual (2012) find a positive correlation between Good Governance and Human Wellbeing, but no significant correlation with Environmental Wellbeing. Two factors, income and natural resources, play a discriminating role. The OECD Better Life Index includes a page stating that "The measurement revolution has already started". Referring to the many calls for new tools to measure development towards sustainability, even more so after Rio+20, they refer to the SSI as an easy and transparent tool that meets the need of information for policy purposes and provides a clear message to the public (OECD, 2012).

Esty and Ivanova (2002) advance the case for a Global Environmental Mechanism based on a central argument that the inescapable global environmental threats require collective action internationally demanding an institutional mechanism at the global level. Amongst three core principles they list the provision of adequate information and analysis to characterize problems and track trends.

2.6 MEASURING WELL-BEING

This section of the literature review could have followed directly under section 2.5 above, however it appears that a new trend is emerging. This trend changes the focus away from measuring sustainable development and moves it towards measuring progress and or well-being. The purpose of the separation is subtle and this sub-section serves to highlight this development.

Besides the UNECE, OECD and Eurostat (2009) initiative Eurostat has done extensive work in "Measuring progress towards a more sustainable Europe" In their 2007 monitoring report (Eurostat, 2007) they state that measuring progress in Sustainable Development is an integral part of the renewed sustainable development strategy (SDS). They envisage producing a monitoring report every two years based on the European Union set of Sustainable Development Indicators (SDIs). The SDIs follow the ten themes set out in the SDS and cover the three TBL dimensions plus an institutional dimension. The set of SDIs are contained in a three-level pyramid, refer Figure 12, where the headline (level 1) indicators monitor the overall objectives of the SDS, level 2 comprise operational SDS objective indicators, and level 3 indicators which relate to actions outlined in the SDS.

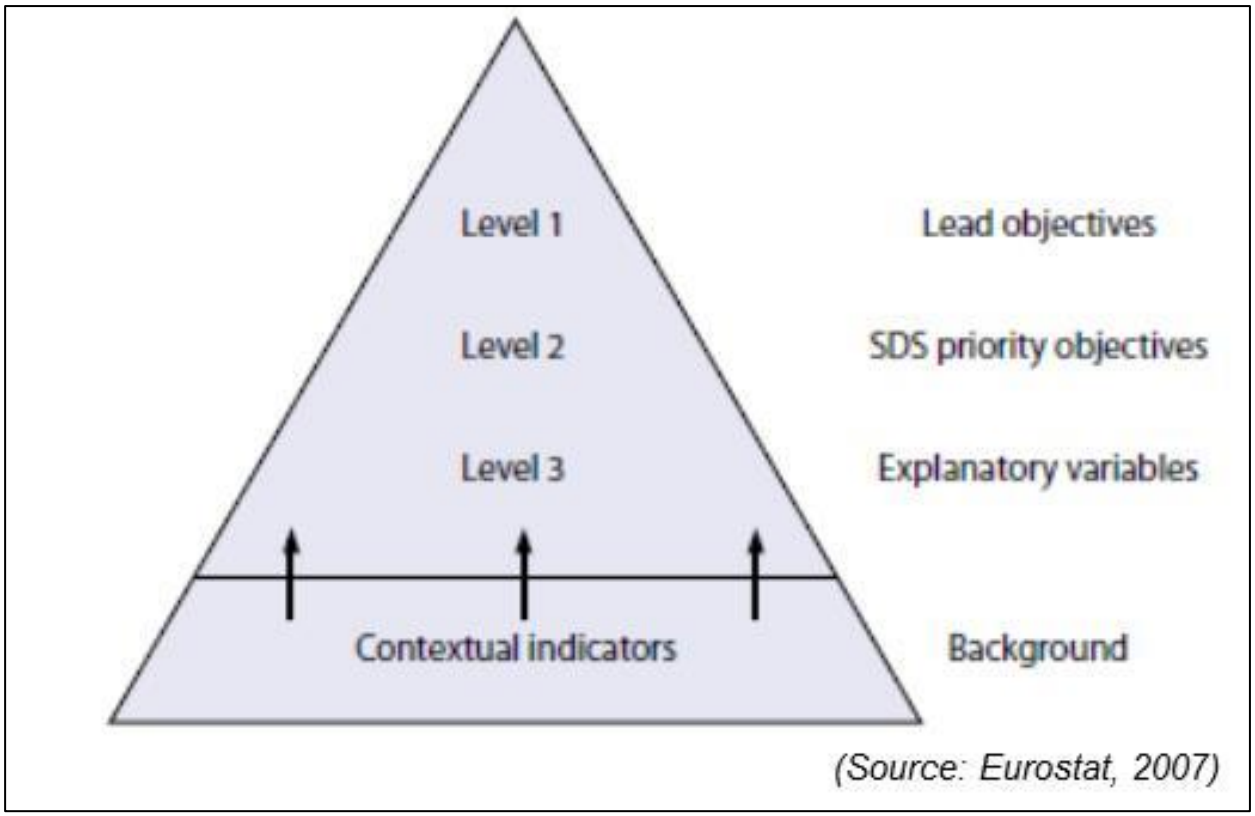


Figure 12: Eurostat Sustainable Development Indicators pyramid

The OECD too, has embarked on establishing its own initiative in its “How’s life? Measuring Well-being” report (OECD, 2011). This document can be seen alongside its “better life” initiative which sets out a “Compendium of well-being indicators” (OECD, 2011a), and its report on the OECD’s work on sustainable development (OECD, 2011b). Figure 13 illustrates the well-being framework. Further evidence of higher level organisations making a contribution in this area is the World Economic Forum who are committed to improve the state of the world by engaging business, political, academic and other societal leaders in order to shape global, regional and industry agendas. They recently published a “Well-being and Global Success” (WEF, 2012a) report discussing the search for new models of progress. Noting that whilst economic growth has value “what is wanted is well-being”. In terms of measuring well-being they note that “if you treasure it, measure it” and refer to the above mentioned OECD attempts to measure and redefine progress. The three key areas of the report are: me and my work; me and my family; and me and my community.

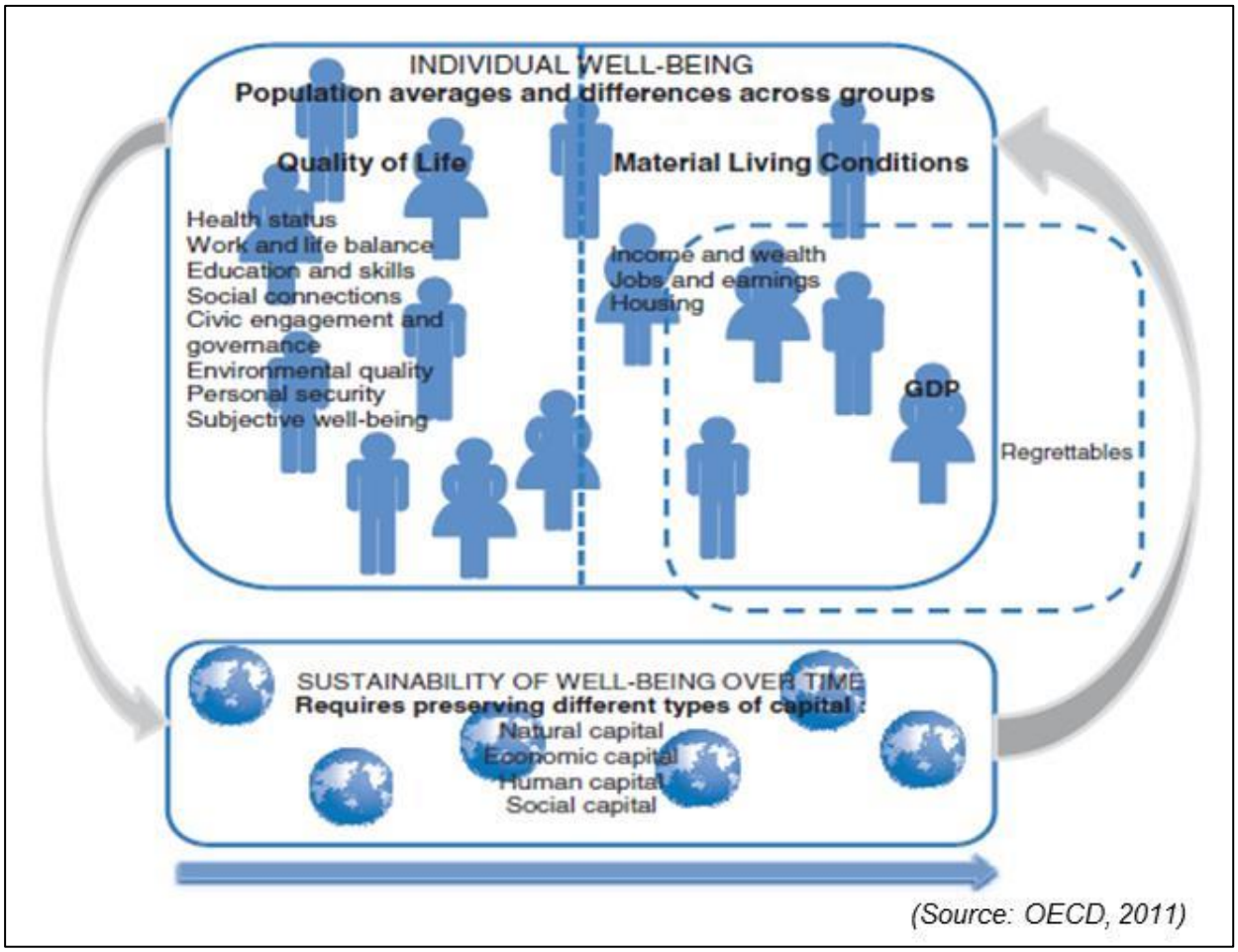


Figure 13: Framework for OECD well-being indicators

The New Economics Foundation (NEF, 2009a), who describe themselves as a think-and-do tank that aim to improve quality of life by challenging mainstream thinking on TBL issues, have taken the concept of National Accounts into the realms of measuring well-being. Presenting “a

radical, robust proposal to guide the direction of modern societies and the lives of people who live in them", it shows why national governments should measure people's subjective well-being.

In 2011 the NEF (NEF, 2011) published another report entitled "Measuring our progress: The power of well-being". This report provides an approach to measure well-being based on the NEF's dynamic model. Stating that a successful society is one in which people have high levels of sustained well-being over time, it measures progress in three key areas: the goal of universally high levels of well-being; the sustainable use of natural resources; and human systems that achieve stable and productive economies. Their Happy Planet report (NEF, 2012) is discussed later in this research project.

Talberth *et al.* (2006) outline the Genuine Progress Indicator (GPI) as a tool for sustainable development and an alternative to GDP. A variant of the Index of Sustainable Economic Welfare (ISEW) first proposed by Daly and Cobb (1994), the GPI has been vetted by the scientific community and is regularly used by governments worldwide. Whilst using the same consumption data as GDP it makes a number of deductions, thereby differentiating between economic activity that reduces natural and social capital, and activity that improves such capital. It is designed to measure sustainable economic welfare as opposed to standalone economic activity. An example of the utilization of the GPI is evidenced in the Päijä-Häme (2011) report conducted in Finland, which states that the GPI is an indicator that attempts to capture the TBL aspects of welfare into one single index by artificially pricing environmental and natural resource degradation. Posner and Costanza (2011) reviewed a number of ISEW and GPI studies at various scales and recommend that the GPI research community develop a standardized measurement approach for using improved indictors in official policy settings.

This theme is also adopted by The Earth Institute (Sachs *et al*., 2012) in their "World Happiness Report". It cites that we live in a world of stark contradictions, like growing economies whilst destroying natural resources, and seeing great progress in economic development measured in conventional terms whist dealing with crises of obesity, depression, smoking, depression and modern day diseases. They suggest that if we act wisely, the Earth can be protected whilst raising the quality of life. By adopting lifestyles that improve happiness whilst reducing environmental damage, they say that the pursuit of happiness is intimately linked to the pursuit of sustainable development. They have developed a Gross National Happiness Index (GNH Index).

In a summary for decision-makers the United Nations University-Human Development Programme (UNU-IHDP, 2012) note that the concept of the "Green Economy" was a main theme at Rio+20. Reflecting on the state of the planet and new models going forward, the

concept is seen as a genuine opportunity to prioritize both human and other species well-being for both present and future generations. The report lists six key findings including: "If we are to move toward a green economy, we need a new way to understand and measure wealth. Our measurements of wealth need to encompass what a green economy seeks to achieve: environmental sustainability and human well-being."

This review - to measure Sustainable Development and its latest trend Well-being - is best concluded with reference to a second United Nations University-Human Development Programme report, drafted together with UNEP - the Inclusive Wealth Report (IWR) (UNU-IHDP and UNEP, 2012:xiii-xiv). Released at the Rio +20 Earth Summit the authors state that despite the rich content of the Resilient People, Resilient Planet report (UN PGS, 2012) it is short on practical solutions. Citing the most valuable short-term recommendation as being the replacement of current development indicators (GDP etc.) with more comprehensive wealth metrics, they state that without "quick, decisive international action to prioritize sustainability over the *status quo*, the report risks suffering the fate of its 1987 predecessor, the pioneering Brundtland Report". Stating that "we need new indicators that tell us if we are destroying the productive base that supports our well-being" they apply a conceptual framework, Figure 14 (UNU-IHDP and UNEP, 2012:15), which begins with human well-being as the end in mind. Noting that well-being is governed by evolving cultural norms and policy, they see this as influencing the manner in which societies use different forms of capital assets, which in turn, are the base or foundation for the economic production process, with ecosystems being critical in supplying the natural capital asset base. They propose their Inclusive Wealth Index (IWI) as a useful tool for economic, environmental and social planning. Amongst their findings they state that "to be clear, the IWI is an important step forward in understanding human well-being, the economy, wealth, and sustainability. Indeed, it's an enormously valuable input into decision making" (UNU-IHDP and UNEP, 2012:268) , For now, they see the IWI being used in conjunction with the GDP, the HDI and specific environmental indicators like the EF and ESI to obtain the most comprehensive perspective.

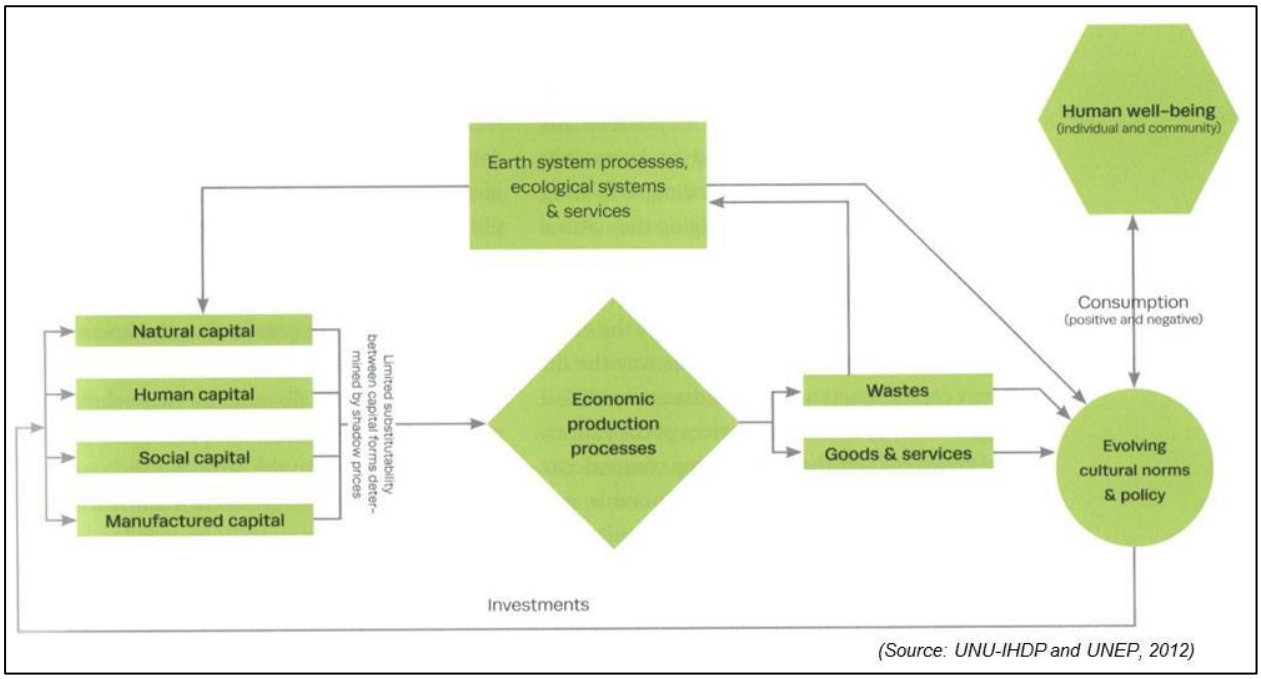


Figure 14: The productive base and human well-being

OUTCOMES

With reference to Figure 2 and Table 1, the outcomes to meeting the primary aim of the study, reviewed in section 2.7 to 2.11, comprise part of the review to answer research question 2.

Taking Recommendation 39 (UN PGS, 2012) as the cue, phase III of this literature review identifies the most relevant indicators. As mentioned in the introduction this is scaled at a global level. That is to say that the index in question had to include all nation states worldwide without any form of exclusion to be considered. Given that none of the indices that are finally included span all the 191 countries (universe) due to lack of data, a minimum of 100 countries being reported on was set, in order to be eligible for the single integrated index.

The most practical way in which to summarise the review of the most relevant indicators is to discuss them in a structured format which makes a comparison somewhat easier. A similar exercise was conducted by van de Kerk and Manual (2010) for the Annual Meeting of Sustainable Development Experts (AMSDE). The AMSDE recognize the urgent need for SDIs and note that this is even more urgent beyond the GDP era, and is a crucial theme in the work of the OECD. The AMSDE study identified 26 sets of indicators in seven categories – development (3), overall wellbeing (3), human wellbeing (3), environmental wellbeing (5), economic wellbeing (4), general sets of indicators (3), and country sets (5). The AMSDE state that “Better measures lead to better policies” and that they have to address two questions:

- "Define an index or a set of indicators which measures a country's progress to a sustainable society. Beside specific requirements which any country may have, there is a need for a uniform set of indicators to enable benchmarking of countries.
- Suggest an economic indicator that better reflects the progress of a country's economy and its contribution to the overall level of well-being enjoyed by its citizens".

With this in mind the following twenty-seven indices were reviewed for inclusion in the analysis step in Chapter 4, eleven of which are dealt with by van de Kerk and Manual (2010) described above. A summary table of each of the twenty-seven indices are tabulated in Tables 24 to 28 (Appendix VIII), which provides a common set of details to describe the characteristics of the individual indices. Twenty of the twenty-seven are taken into the analysis step as they contain global country level data in the public domain that can be investigated. Appendix II – Grid, lists the elements that make up each of the twenty indices.

2.7 ENVIRONMENT/PLANET DIMENSION INDICES

Five indices, Table 24 (Appendix VIII):

- Ecological Footprint – EF (Ewing *et al*., 2010).
- Environmental Performance Index – EPI (Emerson *et al.*, 2012).
- Environmental Sustainability Index – ESI (Esty *et al.*, 2005).
- Environmental Well-being – EW (van de Kerk and Manual, 2012a).
- Ecosystem Wellbeing Index – EWI (Prescott-Allen, 2001:59-106)

2.8 SOCIAL/PEOPLE DIMENSION INDICES

Six indices, Table 25 (Appendix VIII):

- Human Development Index – HDI (UNDP, 2011).
- Inequality-adjusted HDI – IHDI (UNDP, 2010) and (UNDP, 2011).
- Quality of Life Index – QLI (Economist Intelligence Unit, 2005).
- Income Gini coefficient – Gini (CIA, 2012).
- Human Well-being – HW (van de Kerk and Manual, 2012a).
- Human Wellbeing Index – HWI (Prescott-Allen, 2001:13-58).

2.9 ECONOMIC/PROSPERITY DIMENSION INDICES

Five indices, Table 26 (Appendix VII):

- Gross Domestic Product – GDP (World Bank, 2011 in UNDP, 2011).

- Gross National Income per capita – GNI (UNDP, 2011).
- Adjusted Net Savings – ANS (World Bank, 2011 in UNDP, 2011).
- Global Competitiveness Index – GCI (WEF, 2012).
- Economic Well-being – EcW (van de Kerk and Manual, 2012a).

2.10 SUSTAINABLE DEVELOPMENT COMPOSITE INDICES

The concepts of three of these composite indices are referred to in the Chapter 4 data analysis, as such specific reference is made to each of them.

Four indices, Table 27 (Appendix VIII):

- Legatum Prosperity Index – LPrI (Legatum, 2012).
- Happy Planet Index – HPI (NEF, 2009, 2009a, 2011 and 2012) – This index essentially takes the Economic and Social dimensions into a happy life years dimension which resembles the latest literature that is focussing on measuring well-being – chapter 2.6. The Ecological Footprint is taken as the proxy for the Environment dimension. Figure 15 illustrates that only one in 143 country's meets the green target

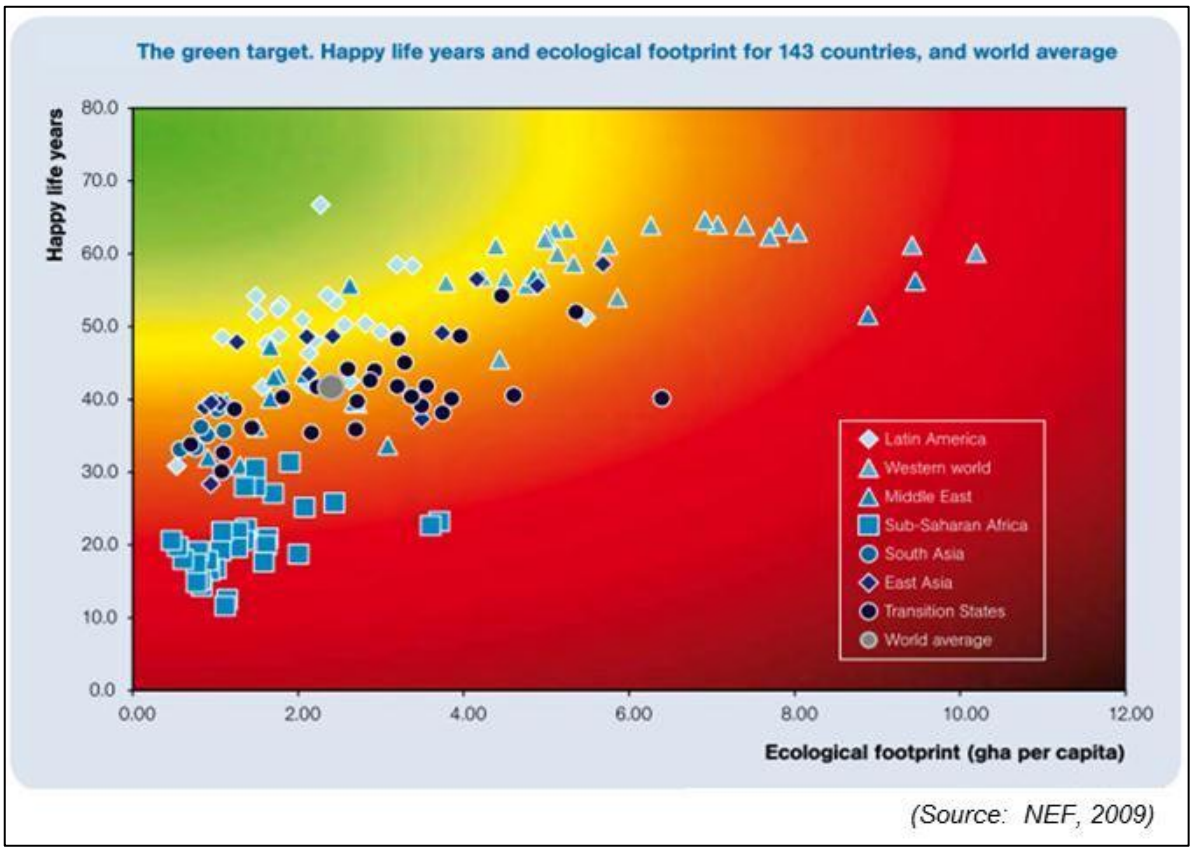


Figure 15: Happy Planet Index – Green target

- Sustainable Society Index – SSI (van de Kerk and Manual, 2012a) – This is the only index that conscientiously includes all three TBL dimensions into its scoring methodology; refer Figure 16 for their framework. This index, initiated in 2006, is updated every second year. The authors of this document, van de Kerk and Manual have compiled a number of papers in search of establishing an adequate set of indicators in order to measure country sustainability, noting that in this search none of them fits their needs (van de Kerk and Manual, 2008, 2010, and 2012).

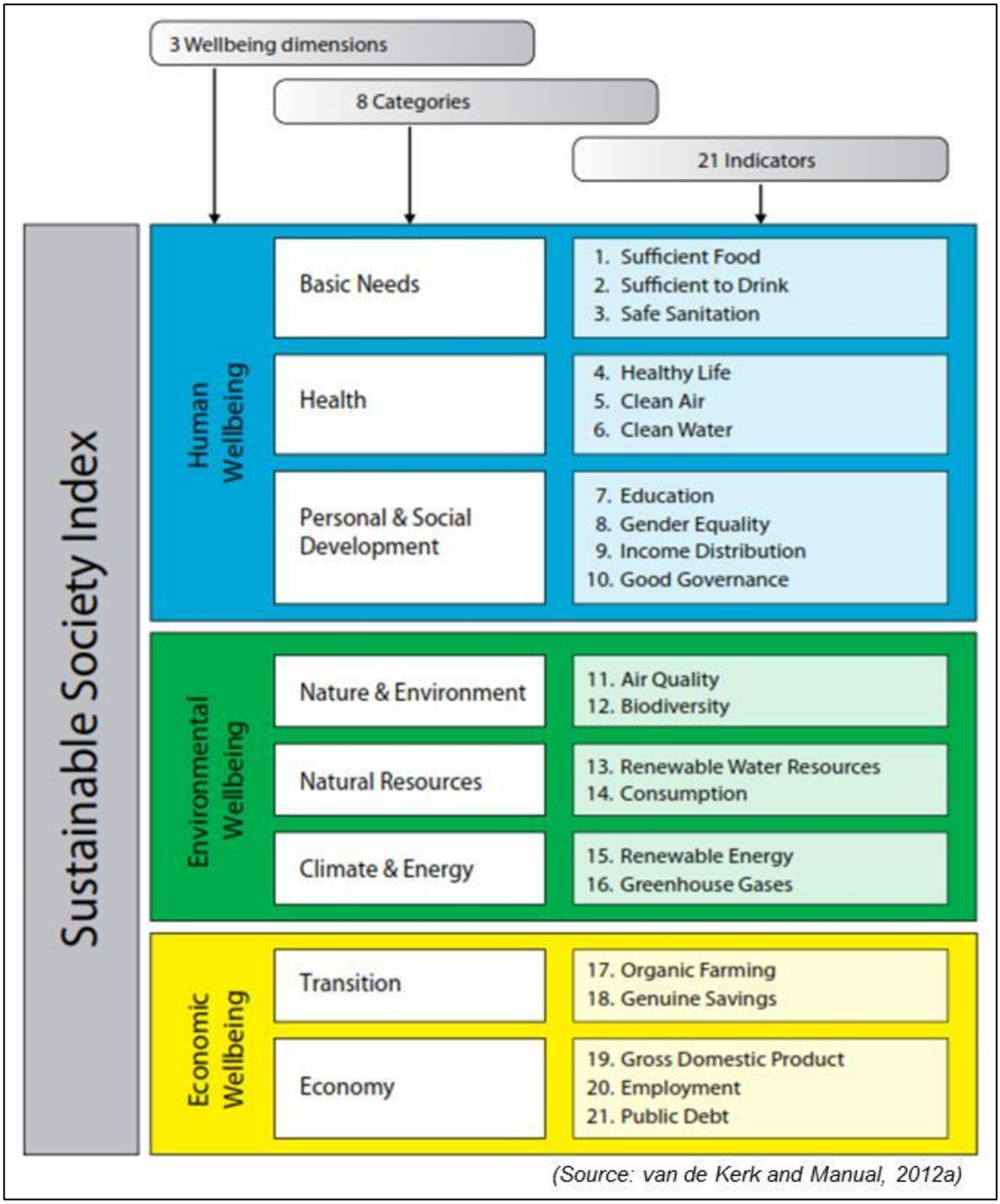


Figure 16: Sustainable Society Index - Framework

- Wellbeing Index – WI (Prescott-Allen, 2001:1-342) – This index covers all three TBL dimensions by combining the Social and Economic into a Human Wellbeing dimension, with Environment standing alone as the Ecosystem Wellbeing dimension. The bottom figure in Figure 17, in Guijt and Moiseev (2001), provides the framework for the two dimensions, which also illustrates in the top figure, the barometer of sustainability to visualise specific countries sustainability. Curiously, this foundational and comprehensive index has not been updated since it was developed in 2001.
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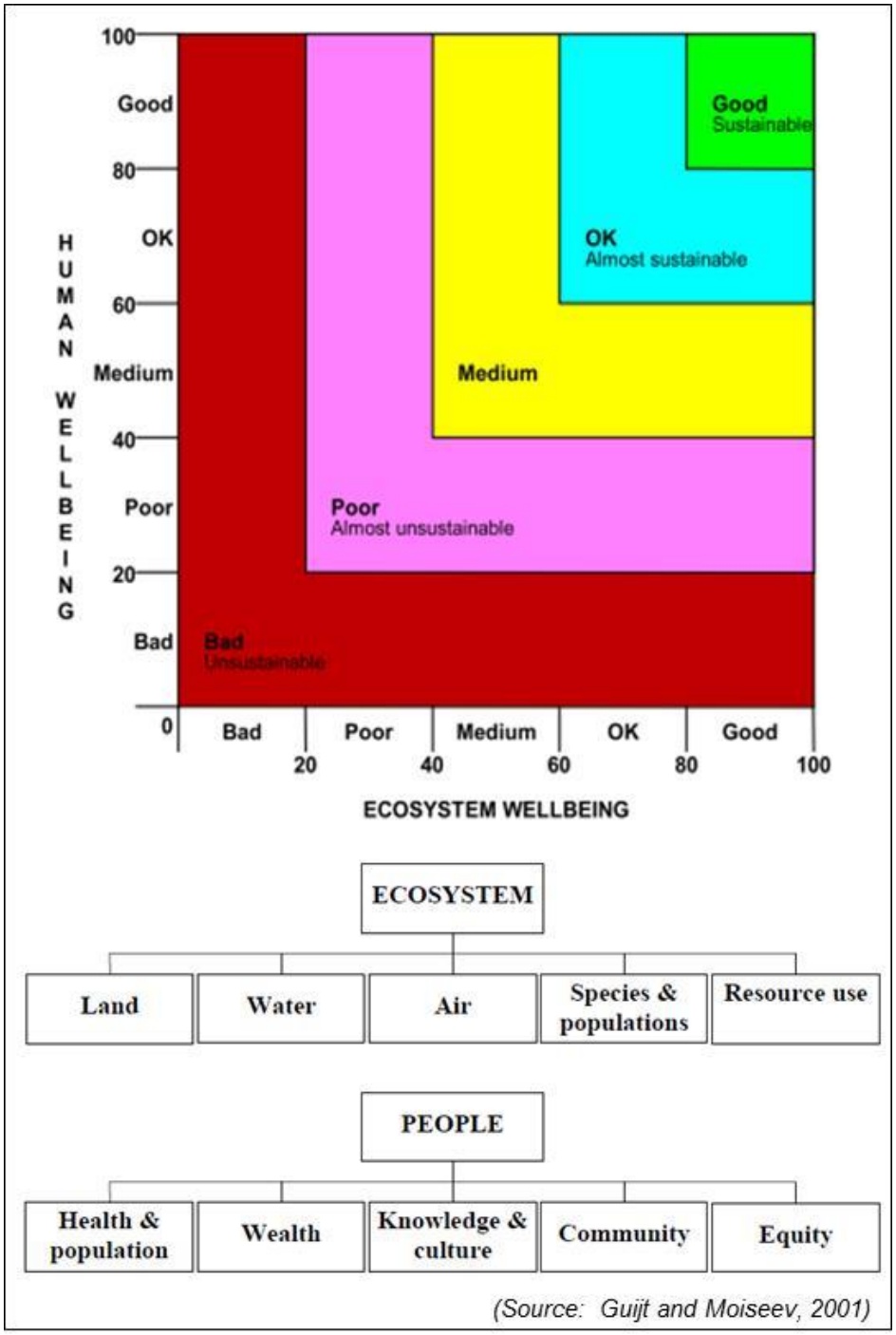


Figure 17: Wellbeing of Nations – Barometer of Sustainability and Framework

2.11 COMPLEMENTARY INDICES CONSIDERED

Seven indices, Table 28 (Appendix VII):

- Index of Sustainable Economic Welfare – ISEW (Daly and Cobb, 1994).
- Genuine Progress Indicator – GPI (Talberth *et al.*, 2006).
- Gross National Happiness Index – GNI (Sachs *et al*., 2012).
- Energy Sustainability Index – EneSI (World Energy Council, 2012).
- Your Better Life Index – YBLI (OECD, 2011).
- Inclusive Wealth Index – IWI (UNU-IHDP and UNEP, 2012).
- Living Planet Index – LPI (WWF, 2012).

The Living Planet Index (LPI) is different from all the other indices in that it is not a country evaluation, but a species evaluation. However, from a sustainability perspective at a global level, the LPI reflects the health of the planet's ecosystems (WWF, 2012). Given the importance attached to the MDGs, the review also looked whether a MDG index was available, without success. The report card produced by the Overseas Development Institute (ODI, 2010) considers seven of the eight 2015 goals in absolute and relative terms individually for developing countries only, and does not provide an overall report card.

2.12 SOUTH AFRICAN SUSTAINABILITY GOVERNANCE

The response to meeting the secondary aim of the study is reviewed in this section and is examined to answer research question 6.

Besides the legislation of specific Acts like the Constitution (1996) and the National Environment Management Act (NEMA) (107/1998), the governance of Sustainability and Sustainable Development in South Africa has progressed into a National Strategy approved by Cabinet (DEA, 2011). The overarching Constitution (1996), includes for example Section 24, which deals with the so-called 'environmental right' and refers to an environment not detrimental to health and well-being, and a protected environment; while Section 27 deals with access to health care, food, water, and social security. This informs the National Environment Management Act (NEMA) (107/1998) where the sustainable development intentions are made clear in the preamble and definition section, which defines sustainable development as "means the integration of social, economic and environmental factors into planning, implementation and decision-making so as to ensure that development serves present and future generations".

2.12.1 National Framework for Sustainable Development

According to a document, titled People-Planet-Prosperity: A National Framework for Sustainable Development in South Africa (NFSD -DEAT, 2008), South Africa aspires to be a sustainable, economically prosperous and self-reliant nation state that advances efficient and effective integrated planning and governance through national, regional and global collaboration. The NFSD alludes to South Africa having an ecological footprint of 2.2 planet earths and sets out principles to serve as a "compass" to ensure South Africa's development path unfolds in the direction of sustainability.

The NFSD notes that the interdependence between people – planet – prosperity is evident in the Millennium Development Goals, and that the way in which we live in South Africa and the development path we are currently pursuing, has elements of being unsustainable and is not viable in the long term. The intention is not to create a master plan but rather a strategy to build on existing programmes and strategies. It is accepted that social, economic and ecosystem factors are embedded within each other, and are underpinned by governance systems. The definition for SD is consequently illustrated in Figure 1 and represents a systems approach to sustainability. It seeks to build on the definition of Sustainable Development set out in the National Environmental Management Act (NEMA) (107/1998), and highlights the importance of institutions and systems of governance in implementation and oversight activities.

The NFSD refers to the broad consensus on two specific challenges for the South African democracy. Firstly, boosting of economic growth to an average of 6%, whilst ensuring a more equitable distribution of economic wealth; and secondly how to eradicate poverty and achieve the Millennium Development Goals (MDGs). A commitment to SD means that a third challenge emerges which is how to decouple economic growth and poverty eradication from rising levels of natural resource use and waste per capita over time.

The NFSD, summarised in Table 3, frequently refers to the use of indicators to monitor measure and evaluate implementation and progress. A synopsis of the NFSD is important in order to frame the discussion:

- Vision - intended to give effect to the integration of governance and action in decision-making.
- Principles - set out on three levels, relate to the fundamental human rights enshrined in the constitution, the conditions that are required for a sustainable society, and thirdly those applying to implementation.
- Pathways - set out the five strategic priority areas to achieve SD.

- Three cross-cutting trends are highlighted - climate change, rising oil prices and globalization - that will impact shorter term social and economic policies.
- Macro-social trends provide an analysis of the supply of natural resources so as to ensure pursuit of economic development via shared growth to eradicate poverty.

Table 3: National Framework for Sustainable Development

People - Planet - Prosperity **National Framework for Sustainable Development**
Vision
South Africa aspires to be a sustainable, economically prosperous and self-reliant nation state that safeguards its democracy by meeting the fundamental human needs of its people, by managing its limited ecological resources responsibly for current and future generations, and by advancing efficient and effective integrated planning and governance through national, regional and global collaboration.
Principles
1 Fundamental principles 1 Human dignity and social equity 2 Justice and fairness 3 Democratic governance **2 Substantive principles** 1 Efficient and sustainable use of natural resources 2 Socio-economic systems are embedded within, and dependent upon, eco-systems 3 Basic human needs must be met to ensure resources necessary for long-term survival are not destroyed for short-term gain **3 Process principles** 1 Integration and innovation 2 Consultation and participation 3 Implementation in a phased manner
Pathways to Sustainable Development
1 Enhancing systems for integrated planning and implementation 2 Sustaining our ecosystems and using natural resources efficiently 3 Economic development via investing in sustainable infrastructure 4 Creating sustainable human settlements 5 Responding appropriately to emerging human development, economic and environmental challenges

(Source: Adapted from DEAT, 2008)

2.12.2 National Strategy for Sustainable Development

The approval of the NFSD (DEAT, 2008) by Cabinet in 2008 was followed by Cabinet approval on 23 November 2011 of the National Strategy for Sustainable Development and Action Plan (NSSD 1) (DEA, 2011). Building on the NFSD, the implementation of the NSSD 1 (2011-2014) will inform the NSSD 2 which applies to 2015-2020. Seen as a proactive strategy that regards Sustainable Development as a long-term commitment, the NSSD 1 combines environmental protection, social equity and economic efficiency with the vision and values of the country.

The NSSD 1 refers to the three ten year UN Summits - the 1992 Rio Earth Summit, the 2002 Johannesburg World Summit on Sustainable Development, and the 2012 Rio+20 – where the first two provided a platform to learn and begin implementing sustainability practices, and the third 2012 Rio+20, as identifying two important themes, the green economy, and institutional framework for Sustainable Development.

The NSSD 1 identifies 113 interventions to monitor its implementation, together with twenty headline indicators which include the Development Indicators, the MDGs and 12 government outcomes. Section 1.5 links the NSSD 1 to the National Planning Commission, the New Growth Path and the Industrial Policy Action Plan. With reference to Table 4, the NSSD has five strategic priorities and objectives which lead into twenty headline indicators, note the alignment of the vision to the NFSD (DEAT, 2008). Besides the document not specifically listing the twenty headline indicators no mention is made of any indices.

A concluding remark of the NSSD 1 states “Urgent action is required to direct the development path of the country towards sustainability, particularly in light of the potential consequences of climate change, the financial recession, job losses and declining natural resources”.

SOUTH AFRICA'S NATIONAL STRATEGY FOR SUSTAINABLE DEVELOPMENT AND ACTION PLAN (NSSD 1)



VISION	"South Africa aspires to be a sustainable, economically prosperous and self-reliant nation state that safeguards its democracy by meeting the fundamental human needs of its people, by managing its limited ecological resources responsibly for current and future generations, and by advancing efficient and effective integrated planning and governance through national, regional and global collaboration"				
GOALS	• Develop and promote new social and economic goals based on ecological sustainability and build a culture that recognises that socioeconomic systems are dependent on and embedded in ecosystems • Increase awareness and understanding of the value of ecosystem services to human wellbeing • Ensure effective integration of sustainability principles into all policies, planning and decision-making at national, provincial and local levels • Ensure effective system-wide integration and collaboration across all functions and sectors • Monitor, evaluate and report performance and progress in respect of ecological sustainability in relation to socioeconomic goals				
STRATEGIC PRIORITIES	Enhancing systems for integrated planning and implementation	Sustaining our ecosystems and using natural resources efficiently	Towards a green economy	Building sustainable communities	Responding effectively to climate change
OBJECTIVES	• Enhance effective **governance, and institutional structures** and mechanisms to achieve sustainable development and meeting the Millennium Development Goals (MDG) and Johannesburg Plan of Implementation (JPOI) goals and targets • Strengthen **monitoring and reporting** for improved environmental performance by government and the private sector	• Value, protect and continually enhance **environmental assets** and natural resources	• A **just transition** towards a resource-efficient, low-carbon and pro-employment growth path	• Create community awareness, participation and work together to protect their environment through **changing the attitudes and behaviour in consuming** resources sustainably and responsibly • Develop and support quality housing projects/programmes including **building community self-sufficient** farming strategies, indigenous knowledge, the sustainable production of herbs and traditional medicine, and businesses to secure societal equity and cohesion	• A fair contribution to the global effort to achieve **the stabilisation of greenhouse gas concentrations** in the atmosphere at a level that prevents dangerous anthropogenic interference with the climate system • Effectively **adapt** to and manage unavoidable and potential damaging climate change impacts through interventions that build and sustain South Africa's social, economic and environmental **resilience** and emergency response capacity
INTERVENTIONS	11 interventions	40 interventions	17 interventions	21 interventions	18 interventions
HEADLINE INDICATORS	3	6	4	4	3
INSTITUTIONAL	National Committee on Sustainable Development (NCSD): spheres of government Civil society, private sector, academia, multi-stakeholder and independent review				
EVALUATION AND FEEDBACK	**Planning, implementation, monitoring evaluation and reporting**				

(Source: DEA, 2011)

2.12.3 Environmental Sustainability Indicators and State of Environment

The South African Environmental Outlook (DEAT, 2006 and DEAT, 2006a) provides an assessment of the state of South Africa's environment, describing drivers of change, trends and responses. It provides a useful example of how indicators have been used to measure environmental progress. Reporting on a range of indicators it analyses trends since the 1999 report. Table 5, adapted from DEAT (2006 and DEAT 2006a), provides the State of Environment (SoE) at a glance.

Building on the DPSIR model, and informing the South African Environmental Outlook (DEAT, 2006 and DEAT 2006a) process, a more detailed indicator and measurement analysis is initiated by the "Environmental Sustainability Indicators Technical Report 2010" (DEA, 2010). Referring to the Brundtland Report (Brundtland, 1987) as the catalyst to capture the concept of Sustainable Development, the Technical Report notes that policy makers globally are identifying indicators that reflect prosperity, well-being and sustainability. Comprising five Environmental Sustainability (ES) categories, these lead into 20 indicators, which in turn cover the 45 variables. The realisation conditions of the five categories are set out below, which is followed by Table 6 which describes the indicators and variables:

- **State of environmental systems** - ES can only be realised if vital environmental systems are maintained at healthy levels.
- **Stresses on environmental systems -** ES can only be realised if levels of human impacts are low enough not to cause harms to environmental systems.
- **Human vulnerability to environmental change -** ES can only be realised if people and social systems are not vulnerable to environmental change.
- **Social and institutional capacity to cope with environmental change -** ES can only be realised if the necessary institutional capacity and underlying social patterns of skills, attitudes and networks that foster effective responses to environmental challenges exist.
- **Ability to respond to the demands of global stewardship -** ES can only be realised if there is cooperation with other countries to manage common environmental challenges.

Table 5: State of Environment at a Glance

STATE OF ENVIRONMENT TRENDS (KEY FINDINGS SCORECARDS)

Moving in the right direction | No improvement / uncertain trend | Cause for concern

	ENVIRONMENTAL GOVERNANCE (page 22)	
1	Role of South Africa in international environmental governance	Increasing
2	Access to environmental information	Improving
3	Enforcement of environmental management legislation	Improving
4	Delivery of services by local government	Improving
5	Environmental data (page 38)	Improving
	Overall SOER: International indicators (page 39)	
6	Ecological Footprint per person	Higher than
7	Environmental Sustainability Index	Declining

	LAND (page 24)	
1	Extent of land degradation	Uncertain
2	Area used for grazing (Availability of arable land)	Declined
3	Food production per person	Decreasing
4	Food productivity per unit land area	Increasing
5	Conservation tillage	Increasing
6	Land restitution	Increased

	BIODIVERSITY AND ECOSYSTEM HEALTH (page 26)	
1	Biodiversity loss	Increasing
2	Ecosystem health	Declining
3	Human pressure on ecosystems	Increasing
4	Natural resources that support livelihoods	Rapidly Declining
5	Levels of abalone poaching	Increasing
6	Programmes to rehabilitate ecosystems	Increasing
7	Rate of spread of alien invasive species	Increasing

	INLAND WATER (page 28)	
1	Use of available water resources	Increasing
2	Freshwater flows	Decreasing
3	Water Quality	Variable Deteriorati
4	Salinity levels in surface water	Variable Increasing
5	Health of river ecosystems	Declining

	MARINE AND COASTAL RESOURCES (page 30)	
1	Threats to marine biodiversity	Increase
2	Populations of abalone and linefish	Decline
3	Number of fish species listed as endangered or vulnerable	Increasing
4	Sardine fishery	Recovering
5	Uncontrolled coastal development	Increasing
6	Daily wastewater discharge into marine and coastal waters	Increased
	Coastal development (page 38)	
7	Blue flag beaches	Increasing

	ATMOSPHERE (page 32)	
1	Air quality in general	Decreasing
2	Health problems due to air pollution	Increasing
3	Vehicle exhaust emissions	Increasing
4	Greenhouse gas emissions	Increasing
5	Energy consumption	Increased
6	Households with electricity	Increased
7	Use of renewable energy	Increasing
8	Energy efficiency (page 38)	Low
	Climate Change (page 38)	
9	Greenhouse gas emissions from road transport	Increasing
10	Greenhouse gas emissions per person	High
	Ozone depletion (page 39)	
11	Use of ozone-depleting substances	Decreased
	Perstistent organic pollutants (page 39)	
12	Concentrations of persistent organic pollutants	Unknown

	HUMAN SETTLEMENTS (page 34)	
1	Urban sprawl	Increasing
2	Informal settlements	Expanding
3	Housing backlogs	Increasing
4	Slum households	Increased
5	Households with access to piped water	Increased
6	Households lacking access to good basic services	Increased
7	Households with access to adequate sanitation	Increased

NOTE:

Trend information in the report that is not in the sco

Trend information on the scorecard that is not in the

This table is based on the reports key finding categ

	HUMAN VULNERABILITY (page 36)	
1	Human Poverty Index	Increased
2	Vulnerability to climate change and declining water quality and natural	Increasing
3	Early warning system	Improving
4	Human Development Index (page 39)	Decreased

(Source: Adapted from DEAT, 2006)

Table 6: Environmental Sustainability Indicators – Technical Report

	Indicator no.	Indicator	Variable no.	Variable description
Environmental systems	1	Air quality	1	Domestic fuel burning
	2	Biodiversity	2	Threatened bird, mammal, amphibian and reptile species (known)
			3	Threat and protection status of vegetation types per biome
	3	Land	4	Degraded and transformed land
	4	Marine	5	Status of west coast rock lobster
			6	Catches of selected marine species (harvesting)
			7	Marine protected areas
	5	Freshwater	8	Available water per capita
			9	Capacity and levels of dams in South Africa
			10	Freshwater quality
	6	Groundwater	11	Groundwater quantity
			12	Groundwater quality
Reducing environmental stress	7	Air pollution	13	Coal consumption
			14	Vehicles in use per populated area
	8	Ecosystem stress	15	Invasion of alien species
	9	Pollution pressure	16	Percentage change in projected population 1950-2050
			17	Total fertility rate (TFR)
			18	Migration
	10	Waste and consumption pressures	19	Ecological footprint
			20	Energy use
			21	Grazing capacity
	11	Water stress	22	Fertilizer sales
			23	Water stress
Reducing human vulnerability	12	Basic human sustenance	24	Households with access to sanitation
			25	Access to water
			26	Access to refuge removal
	13	Environmental health	27	Death rate from respiratory diseases and tuberculosis
			28	HIV prevalence
			29	Malaria
			30	Under 5 mortality
Social and institutional capacity	14	Eco efficiency	31	Energy efficiency
			32	Hydropower & renew. energy production as a % of consumed energy
	15	Environmental governance	33	% total land area under protected status
			34	% of variables missing from "Rio to Joburg Dashboard"
	16	Private sector responsiveness	35	Environmental management systems
	17	Science and technology	36	Budget for the environment
			37	Digital access index
			38	Number of researchers per 1000 total employment
			39	Budget for R&D
			40	Gross tertiary enrolment rate
			41	Education (primary, secondary and ABET)
Global stew-ardship	18	Greenhouse gas emissions	42	Carbon emissions per capita
	19	Participation in international collaborati	43	Multilateral environmental agreements
	20	Reducing transboundary environmenta	44	Production and consumption of CFCs
			45	Transfrontier conservation areas (TFCAs)

(Source: adapted from DEA, 2010)

2.12.4 National Development Plan and Development Indicators

In May 2010 President Zuma appointed the National Planning Commission (NPC) to draft a vision and plan for South Africa. Two and a half years later in November 2012 the NPC briefed the Parliamentary Monitory Group on the National Development Plan (NDP) (NPC, 2012). The NDP has a vision extending to the year 2030 and is fittingly titled “Our future – make it work”. The NDP makes reference to the Development Indicators (The Presidency, 2011), the fifth edition of which was approved by Cabinet in March 2012. Whilst both documents make reference to indicators and sustainability per se, neither refers to the NSSD (DEA, 2011). The NDP in brief, Figure 18, highlights the elimination of poverty and reduction of inequality as its two primary targets by 2030. Sustainable development and environmental sustainability do not feature in the twenty enabling milestones, and the eighth in ten critical actions refers to environmental sustainability.

2.12.5 Summary of South Africa’s response to measure sustainability

South Africa’s response to measure sustainability is encapsulated in Figure 1. It calls for a governance system that holds the three TBL systems together within a legitimate regulatory framework. Evidence of this starts in legislation with the overarching Constitution which leads to the NEMA. Initiatives that flow from this legislation include the SOER which measures the state of the environment, the NFSD which describes the People-Planet-Prosperity vision and pathways to sustainable development, and the subsequent NSSD 1 which includes 20 headline indicators and calls for urgent action to manage the development path of the country towards sustainability. More recently the NDP highlights the elimination of poverty and reduction of inequality as its two primary targets by 2030.



THE PLAN IN BRIEF

By 2030

- Eliminate income poverty – Reduce the proportion of households with a monthly income below R419 per person (in 2009 prices) from 39 percent to zero.
- Reduce inequality – The Gini coefficient should fall from 0.69 to 0.6.

Enabling milestones

- Increase employment from 13 million in 2010 to 24 million in 2030.
- Raise per capita income from R50 000 in 2010 to R120 000 by 2030.
- Increase the share of national income of the bottom 40 percent from 6 percent to 10 percent.
- Establish a competitive base of infrastructure, human resources and regulatory frameworks.
- Ensure that skilled, technical, professional and managerial posts better reflect the country's racial, gender and disability makeup.
- Broaden ownership of assets to historically disadvantaged groups.
- Increase the quality of education so that all children have at least two years of preschool education and all children in grade 3 can read and write.
- Provide affordable access to quality health care while promoting health and wellbeing.
- Establish effective, safe and affordable public transport.
- Produce sufficient energy to support industry at competitive prices, ensuring access for poor households, while reducing carbon emissions per unit of power by about one-third.
- Ensure that all South Africans have access to clean running water in their homes.
- Make high-speed broadband internet universally available at competitive prices.
- Realise a food trade surplus, with one-third produced by small-scale farmers or households.
- Ensure household food and nutrition security.
- Entrench a social security system covering all working people, with social protection for the poor and other groups in need, such as children and people with disabilities.
- Realise a developmental, capable and ethical state that treats citizens with dignity.
- Ensure that all people live safely, with an independent and fair criminal justice system.
- Broaden social cohesion and unity while redressing the inequities of the past.
- Play a leading role in continental development, economic integration and human rights.

Critical actions

1. A social compact to reduce poverty and inequality, and raise employment and investment.
2. A strategy to address poverty and its impacts by broadening access to employment, strengthening the social wage, improving public transport and raising rural incomes.
3. Steps by the state to professionalise the public service, strengthen accountability, improve coordination and prosecute corruption.
4. Boost private investment in labour-intensive areas, competitiveness and exports, with adjustments to lower the risk of hiring younger workers.
5. An education accountability chain, with lines of responsibility from state to classroom.
6. Phase in national health insurance, with a focus on upgrading public health facilities, producing more health professionals and reducing the relative cost of private health care.
7. Public infrastructure investment at 10 percent of gross domestic product (GDP), financed through tariffs, public-private partnerships, taxes and loans and focused on transport, energy and water.
8. Interventions to ensure environmental sustainability and resilience to future shocks.
9. New spatial norms and standards – densifying cities, improving transport, locating jobs where people live, upgrading informal settlements and fixing housing market gaps.
10. Reduce crime by strengthening criminal justice and improving community environments.

(Source: NPC, 2012. Red highlighting by author)

Figure 18: National Development Plan in Brief

2.13 REVIEW OF DATA ANALYSIS METHODOLOGIES

The data analysis in chapter 4 includes a number of analytical and interpretation techniques. Methods to convert data into normalized or standardised values include the geometric mean and natural logarithm, which together with software to conditionally format values into a range of three traffic light colours are specifically referred to in chapter 3, section 3.3. Methods to correlate data are specifically referred to in chapter 3, section 3.5.

2.14 OVERVIEW OF LITERATURE REVIEW

This intention of the overview is to provide the main conclusions reached in terms of the review of the literature. These conclusions will inform the empirical part of the study.

The first step, to obtain a broad big picture context of the study, revealed that the concept of sustainability is 40 years old, and that over this period no conclusive definition has been agreed on. The main challenge for sustainability is to balance nation state socio-economic growth with global environmental limits to growth. Coupled to this there is substantial evidence in the literature calling for a move away from measuring success via economic indicators like the GDP, and towards SDIs.

In terms of how action has been taken to address the challenges the response at UN level has been a plethora of initiatives that are all well-meaning, but have yet to turn into a sustainable development measurement revolution. Aligned to this there have been repeated appeals, particularly since the agreement on Agenda 21 at the 1992 Rio Earth Summit , to develop and implement indicators to measure sustainability. The OECD in particular has responded to these appeals and has developed work-in-progress sustainability measurement instruments.

Whilst the outcomes phase found no evidence of any one commonly used global SDI, there are a number of indices that contain sustainability elements which can be integrated to develop a single SDI. Three organisations in particular have taken up the call for SDIs and their literature has been very useful in informing the empirical part of the study.

South Africa’s response to measure sustainability is summarised in Figure 1 which includes a strong governance foundation, this is evident in the Constitution which leads to the NEMA from which the SOER, NFSD and the NSSD 1 follow. Together with the recently announced NDP, which focuses on reducing poverty and inequality, this will inform South Africa’s sustainability performance.

CHAPTER 3: RESEARCH DESIGN AND METHODOLOGY

This chapter describes the methodological design. As already described and illustrated in Section 1.3, Table 1, the research methods are chosen and applied according to the following three steps which comprise the structural representation of the research problem:

- Review the scope of global sustainability related indices that measure nation states (research question 1), so as to discover the extent to which they integrate sustainability elements (research question 2), in order to establish whether a single integrated SDI can be developed (research question 3), and then
- appraise the single integrated SDI to ascertain the extent to which nation state global indices vary (research question 4) and correlate (research question 5) with one another in order to determine what a comparison of these two analyses may reveal. Then separately
- review South Africa's response to measure sustainability and determine how well it performs compared to other nation states (research question 6).

During the literature research process the methodologies of a few indices demanded more attention in terms of how an SDI could be developed. The work of Anand and Sen (1994) in establishing the HDI (UNDP, 2011:168-172) provided the basis on which to choose a certain methodological approach. The 21st edition of this HDR was published by the UN Development Programme in 2011 (UNDP, 2011). This report has stood the scrutiny of time and fits the nature of this study the best. This methodology is also evidenced in the HPI (NEF, 2012) and the SSI compiled by van de Kerk and Manual (2012a).

In order to achieve the overall aim the three steps have been reframed to answer the six research questions. The study does not verify the competence of data produced by the various organisations that compile their indices. It purely analyses these data outcomes, as published. Moreover, although each of these indices does have a data validity protocol, for brevity sake each protocol is not described separately here. However, all data sources are clearly referenced. Refer to Tables 24 to 28 (Appendix VIII) for a common set of characteristics

The research design is based on Mouton (2001) and Leedy and Ormond (2010), who propose ways to link research steps, questions and methods in order to facilitate a coherent whole which provides direction to the researcher and makes it easier to communicate how the research was conducted. From an overall perspective the methodology has the characteristics grounded theory, content analysis and correlational research (Leedy and Ormond, 2010), described below:

- Literature Review – This step is essentially qualitative in nature. Leedy and Ormond (2010:142) describe the major purpose of the grounded theory approach as one that begins with the data and uses the data to develop a theory. It focuses on a process related to a particular topic with the ultimate goal of developing a theory about the process. Whilst this research does not seek to develop a theory it does endeavour to provide a single integrated index that is derived from a grounded theory methodology. Applies to research questions 1, 2 (partly) and 6 (partly).
- Data Analysis - This step is essentially quantitative in nature. Leedy and Ormond (2010:108) describe the characteristics of content analysis as "a detailed and systematic examination of the contents of a particular body of material for the purpose of identifying patterns, themes or biases within that material". This second step also has the characteristics of correlational research which is "a statistical investigation of the relationships between two or more variables". Applies to research question 2 (partly), 3, 4, 5 and 6 (partly).
- Findings – This step interprets the results from each of the six research questions in order to address the overall research aim as described in chapter 1.
- Conclusion – This step synthesises the six research questions and is essentially qualitative in nature.

The basic methodology that has been applied to each sub-question is described separately in the following sections.

3.1 RESEARCH QUESTION 1

What is the scope of the global indices in dealing with sustainability related dimensions of the TBL?

This research question sets the scene for questions 2 to 5 in that it provides a broad overview of the aspects and issues that relate to sustainability per se. With reference to Figure 2 it starts by reviewing the literature to understand the broader picture, set out as challenges, which are then funnelled into understanding the manner in which SDIs fit into measuring sustainability.

3.2 RESEARCH QUESTION 2

To what extent do the indices integrate sustainability elements?

The response phase in research question 1 informs the outcome phase in research question 2, which is focussed on determining the twenty outcome indices in terms of sustainability elements. The review is tabulated in Table 18 (Appendix I) which cross-references the selected indices on the horizontal axis with a list of the nation states on the vertical axis. This table is the pivot that links the output of research question 1 to all further analysis.

The fundamental approach taken was to discover individual indices that benchmark countries on an aspect of sustainability. These indices were then allocated to one of the three TBL dimensions - Environment/Planet, Social/People, and Economic/Prosperity. Indices that spanned the TBL dimensions were allocated to a composite SD dimension. Within each dimension the approach is to ensure that all features of that dimension are covered. The ultimate objective is to determine a single integrated SDI.

The next step is to review each of the selected twenty selected indices by tabulating at the TBL aspects that make up that index. These sustainability elements are transcribed in Table 19 (Appendix II) tabular format, and then cross-referenced to a section headed TBL consolidation of indices – this sets out a basic framework of all the sustainability elements. This table provides a simple visual guide and indicates the extent to which a particular index integrates the sustainability elements.

3.3 RESEARCH QUESTION 3

How can a single integrated SDI index be derived from the global indices?

Four specific calculation methodologies that have been used in the analysis of this research question require an explanation, namely normalization, the geometric mean, the natural logarithm, and conditional formatting:

- Normalization or standardisation – This process converts the disparate indicator measurements (different units of measure values) that each of the twenty indices report to a common unit or performance score. The scale of the performance scores ranges from 0–100, where 100 is best performance and 0 is worst performance. Prescott-Allen (2002) applied this scoring methodology to the Wellbeing of Nations report. The NEF (2009a) explains their use of this methodology, noting that “one of the biggest problems with trying

to bring together or compare different types of information is that they are measured in different units and on different scales. This is just as true when looking at survey data as any other information".

- Geometric mean - Besides the HDR (UNDP, 2011:168-172) using the geometric mean to compute their HDI, it is also used by the NEF (2012) in calculating their HPI, as well as van de Kerk and Manual (2012a) in determining the SSI. van de Kerk and Manual (2012a) note that the aggregation method used previously was the arithmetic average, which offers the possibility of compensation, i.e. low scores in one indicator can be compensated by high scores in a different indicator. However, strong sustainability doesn't allow for compensation. Therefore, a better aggregation method is the geometric average, which reduces this compensation.
- Natural logarithm – The HDR (UNDP, 2011:168-171) make use of the logarithm method for the minimum and maximum values to establish their income index. To achieve human development one does not require unlimited income, and it is therefore adjusted to the logarithm of income. The 2011 HDR applies a minimum income of US$100 per capita and a maximum of US$107,711 (Qatar) in calculating a country's income index via this logarithm method. Similarly, the HPI (NEF, 2009) set a minimum Ecological Footprint at 0, and a maximum of 15.
- Conditional formatting - this applies three basic thresholds, in the form of a traffic light system, whereby green is essentially the upper third of scores, yellow the middle third, and red the lowest third. The Excel software program in the Microsoft Office suite provides a conditional formatting method to analyse a range of data – this ranges from dark green (very good) and flows through to dark red (very poor).

Table 7 describes the normalization methodology that I have applied to each of the twenty indices. The table lists all twenty indices vertically alongside their corresponding unit of measure, the normalization methodology I have applied, and reference to the indices that utilise this methodology.

Table 7: Indices Normalization Methodology

			Indices	Unit of measure	Normalization methodology - Applied by researcher to establish a common unit of measure (Scale: 0-100)	Reference to another index where this methodology was applied
Environment / Planet	1	EF	Ecological Footprint	Hectares per acre	Logarithm Maximum EF = 15 (as per HPI), and Minimum EF = lowest country EF (Timor-Leste 0.44)	HDR (UNDP, 2011:168-172) and HPI (NEF, 2012)
	2	EPI	Environmental Performance Index	0 - 100	Taken directly from EPI	
	3	ESI	Environmental Sustainability Index	0 - 100	Taken directly from ESI	
	4	EW	Environmental Well-being	0 - 10	EW value multiplied by 10	
	5	EWI	Ecosystem Wellbeing Index	0 - 100	Taken directly from EWI	
Social / People	6	HDI	Human Development Index	0 - 1	HDI value multiplied by 100	
	7	IHDI	Inequality-adjusted HDI	0 - 1	IHDI value multiplied by 100	
	8	QLI	Quality of Life Index	0 - 10	QLI value multiplied by 10	
	9	Gini	Income Gini coefficient	0 - 100	Taken directly from Gini	
	10	HW	Human Well-being	0 - 10	HW value multiplied by 10	
	11	HWI	Human Wellbeing Index	0 - 100	Taken directly from HWI	
Economic / Prosperity	12	GDP	Gross Domestic Product per capita	PPP $US	Logarithm of income: Max= $91,379 (Qatar), Min=$100	HDR (UNDP, 2011:168-172) and HPI (NEF, 2012)
	13	GNI	Gross National Income per capita	Constant 2005 PPP $US	Logarithm of income: Max= $107,721 (Qatar), Min=$100	HDR (UNDP, 2011:168-172) and HPI (NEF, 2012)
	14	ANS	Adjusted Net Savings	% of GNI	ANS value multiplied by 100	
	15	GCI	Global Competitiveness Index	1 - 7	GCI value factored to 100 (/7x100)	
	16	EcW	Economic Well-being	0 - 10	EcW value multiplied by 10	
SD Composites	17	LPrI	Legatum Prosperity Index	4 - -4	LPrI scale between maximum and minimum values factored to 100	
	18	HPI	Happy Planet Index	0 - 100	Taken directly from HPI	
	19	SSI	Sustainable Society Index	0 - 10	SSI value multiplied by 10	
	20	WI	Wellbeing Index	0 - 100	Taken directly from WI	
Research Indices	Extra	C3Pi	Combined 3 Primary Index	Research Indices all in percentage terms (0-100)	Geometric mean of EF, HDI and GDP	HDR (UNDP, 2011:168-172)
	21	ENVi	Environment Index		Geometric mean of EF, EPI, ESI, EW and EWI	
	22	SOCi	Social Index		Geometric mean of HDI, IHDI, QLI, Gini, HW, and HWI	HPI (NEF, 2012) and
	23	ECOi	Economic Index		Geometric mean of GDP, GNI, ANS, GCI and EcW	
	24	TBLi	Triple Bottom Line Index		Geometric mean of ENVi, SOCi and ECOi	van de Kerk and Manual (2012a)
	25	SDCi	Sustainable Development Composite Index		Geometric mean of LPrI, HPI, SSI and WI	
	26	GCSDi	Global Composite Sustainable Development Index		Geometric mean of TBLi and SDCI	

This research question is the focal point of the research study, and in that respect is where the bulk of the detailed data analysis takes place. The analysis goes through a number of phases:

- Firstly - The twenty indices selected in sub-question 2, refer Table 18 (Appendix I), are listed by country together with the specific unit of measure their respective organisation has chosen to measure them by, and the index value.
- Secondly – All of the country values in the twenty indices are normalized so as to establish commonality across all twenty indices. Depending on the method used by the organisations to determine their original value, the normalization process did in some cases use the natural log methodology to determine the normalised value. The results of this analysis are reflected in Table 20 (Appendix III), which introduces six research indexes that are derived from the twenty indices. The five Environment/Planet indices are summarised into an Environment Index (ENVi), the six Social/People indices are summarised into a Social Index (SOCi), and the five Economic/Prosperity indices are summarised into an Economic Index (ECOi), each using the geometric mean methodology. These three TBL dimension indices are then grouped into one TBL index (TBLi) also by way of the geometric mean methodology. Similarly, the four composite indices are dealt with in the same manner to derive a Sustainable Development Composite index (SDCi). Finally, the geometric mean of the TBLi and the SDCi is computed to establish an overall index, the Global Composite Sustainable Development index (GCSDi). This normalized table, Table 20 (Appendix III), also introduces the traffic light conditional formatting methodology to enable an “at a glance” method to benchmark how the indices compare with one another by country. Where a country does not have a value, the normalization calculation is reflected as “FALSE”.
- Thirdly – Based on an initial observation of Table 18 (Appendix I), determined by sub-question 2, it is clear that a number of organisations do not calculate values for all the 191 countries in the complete universe on countries, thereby computing the FALSE value. As a first step to provide a single integrated index it was decided to see whether a primary index could be determined from one index each taken from the three TBL dimensions. For this purpose the Environmental Footprint (EF) was taken from the Environment dimension, the Human Development Index (HDI) from the Social dimension, and the Gross Domestic Product (GDP) from the Economic dimension. The geometric mean was used to establish the Combined 3 Primary index (C3Pi), in effect a seventh research index. With 47 countries from the original universe of 191 countries not having all three values, the C3Pi comprises 144 countries.
- Fourthly – Those countries that have values for all twenty indices (n=79) are grouped into a final phase, where each of these countries has a Global Composite Sustainable Development index (GCSDi), Table 22 (Appendix V). Countries that have produced a

GCSDi from less than the twenty indices are automatically excluded. In other words, in order to qualify for this final group a country needs to have values for all twenty indices.

- Fifthly – The analysis then uses the "slice and dice" methodology to compare the three levels of analysis – Universe (n=191), C3Pi (n=144) and GCSDi (n=79). With all the countries divided into four demographic categories - Geographic Region, Planet Earth's (source: Ewing *et al*., 2010), Human Development category (source: UNDP, 2011), and Stages of Development (source: WEF, 2012) – the three levels are compared to one another to assess whether the trends are consistent.

3.4 RESEARCH QUESTION 4

What is the extent of variation between the indices?

This research question methodology relies on the outcome of the analysis in research question 3. The results of research question 4 are appraised to ascertain the extent to which the normalized nation state values for each of the twenty-seven indices vary with one another.

3.5 RESEARCH QUESTION 5

How well do the indices correlate?

The "How's Life? Measuring well-being" report (OECD, 2011) tabulates the correlations between the headline indicators and calculates correlation coefficients at country level. They look for whether high achievement in one dimension of well-being is related to high achievement in another dimension. In the same vein, from a sustainability perspective the three TBL categories, Environment/Planet, Social/People and Economic/Prosperity are multidimensional and dependant on an array of factors. This analysis concept is followed.

Data derived in question 3 is used to correlate each of the twenty-seven indices against one another to establish the strength of these correlations. Furthermore, in certain instances the coefficient of determination is established for specific research indices. The sub-question has been answered using the statistical methods described by Levin and Rubin (1994:613-620). They note that correlation analysis is the statistical tool that describes the degree to which one variable is linearly related to another. They define two measures to describe the correlation between the two variables:

- Coefficient of Correlation (r) – is used to describe how well one variable is explained by another. Its sign indicates the direction of the relationship.

- Coefficient of Determination (r2) – is the square of the coefficient of correlation and is the primary method to measure the extent, or strength, of the association that exists between two variables, X and Y, that is explained by the regression line.

3.6 RESEARCH QUESTION 6

What is South Africa's response to measure sustainability, and how well does it perform?

Over and above the results that South Africa will produce in research questions 3 to 5 it is considered relevant to take a closer look at any specific outcomes that the literature review establishes. These outcomes will then be synthesised with the results from the analysis.

CHAPTER 4: RESULTS OF DATA ANALYSIS

This chapter is structured in relation to the six research questions as described in chapter 1, section 1.3 and Table 1. Structuring the analysis in relation to the different research questions aims to demonstrate that the different questions have been successfully answered.

4.1 RESEARCH QUESTION 1

Refer to the research methodology (chapter 3, section 3.1) that specifically applies to this analysis. In order to answer this question a broad scope was established from which a process was followed to understand the problem (challenges), and then deal with fixing the problem (response), leading to evidence of managing the problem (outcomes). Figure 2 was developed to describe this process in the form of arrows. The analysis is broken down into three steps.

4.1.1 What is the meaning of sustainability?

The purpose was to establish the broad concept of sustainability.

The sustainability context provided the rationale and justification for managing human activity on a finite planet. Whilst it is clear that although the concept is 40 years old and does not have collective agreement on the definition, it does provide the parameters within which human activity should operate - section 2.1. The “Our Common Future” report commissioned by the WCED (Brundtland, 1987:43) provided the commonly used definition, albeit that MacNeill (2012), a lead author in the report, notes that he regrets the exclusion of important features in the definition that were omitted during their debate, omissions that included living within natures limits. Elkington (1998:2) was the first to describe the idea of a TBL to provide an alternative perspective on sustainability, whereby attention is given to the three dimensions of economic prosperity, environmental quality and social justice, the. The NFSD (DEAT, 2008) Figure 1 nested egg diagram, which is used to frame the three TBL dimensions, is considered to be a most useful illustration in which to contextualise the crux of the matter.

4.1.2 What is the crux of the matter?

The purpose was to establish the root cause of the sustainability problem and then establish the broad methods to measure the sustainability of human activity.

In the same year that that the concept of sustainability was described by Ward (Satterthwaite (2006:9) Meadows *et al*., (2004) in 1972 were one of the first to seriously challenge the economic growth paradigm, and the consequential effect on sustainability. Whilst the work of Meadows *et al*., (2004) was in the form of scenarios projected into the future, actual evidence of this beyond limits concern is clear in Steffen *et al*., (2004). This study illustrates the effect that increasing rates of change in human activity (cause), specifically over the past 50 years, is having on global scale changes in the Earth system (Figure 3). Senge (2006) provides a theoretical basis on which limits to growth work with shifting the burden structures merely exacerbating the problem. These problems are identified by Rockström *et al*., (2009) who identify that three of nine planetary boundaries or thresholds have been breached. Against this backdrop - of projected beyond limits scenarios 41 years ago, actual evidence of human activity causing dramatic change in the Earth system over the last 50 years of the past century, and the one third of planetary boundaries being breached - the UN (UN PGS, 2012) reports on a dynamics-as-usual projection of the world to 2050: 9.2 billion people (an increase of 2.2 billion on today) 70% urbanised with high material consumption, an economy that quadruples alongside an 80% increase in energy use, and amongst major degradation in nature and life support systems, a 3-6 degree increase in warming and unabated biodiversity loss. This leads to the main challenge for sustainability - to balance nation state socio-economic growth with global environmental limits to growth. Recent developments on the concept of degrowth policies and a steady state economy discussed by Schneider *et al.* (2010) and O'Niell (2012) will in theory be helpful in overcoming this challenge.

The next step in the analysis then turns to GDP being the fundamental method to measure economic growth since the great depression. In assessing "what matters most" Stiglitz *et al*., (2010) question the reliability of GDP being a reliable indicator of economic and societal progress and discuss "mis-measuring our lives". Similarly, the UN (UNCSD, 2012) refers to the limitations of many indicators masking the irreversibility of pollution and deficiencies in inequality. This concern of the threat posed by human activity to the planet and the challenges this poses (Dodds *et al.,* 2012:123), together with the lack of reliable measures of sustainability trace back over 40 years to the 1972 Secretary-General of the UN Conference on the Human Environment held in Stockholm. In between this the UN at the Rio Earth Summit in 1992 agreed to Agenda 21 (UN CED, 1992) - besides a sustainable development action plan as an outcome this agreement noted that indicators like the GNP do not provide adequate indications of sustainability, and called on countries to develop systems to monitor and evaluate achieving sustainable development by adopting indicators. Broadly speaking, the literature is clear that new methods to measure sustainability are required.

The literature then looked for evidence of measuring progress and useful contributions are found in Anand and Sen (2000) who measure human development at nation state level, and Wackernagel and Rees (1996) who measure nation state Ecological Footprints. These two indices deal with the two conflicting dilemma aspects of beyond limits and socio-economic growth. This dilemma is addressed by Moran *et al*., (2008) who find that the trend in high income countries over the past twenty five years reveals that improvements in their HDIs correspond to a disproportionately larger increase in their Ecological Footprints. That is, "a movement away from sustainability", Figure 6 provides an essential illustration of the problem.

4.1.3 What is being done about it?

The purpose was to establish evidence the how sustainability is being measured on a global scale.

In terms of how action has been taken to address the challenges described above, the response at UN level has been a plethora of initiatives that are all well-meaning, but have yet to turn into a sustainable development measurement revolution. These sustainability initiatives all prepared for Rio+20 include a "Back to our common future" report (UN DESA, 2012) which calls for a renewed political deal, an outcome agreement of 193 countries titled "The future we want" (UN, 2012b) that aims to advance action on sustainable development, and the GEO-5 report (UNEP, 2012 "Keeping track and measuring progress" which shows major economic, environment, social and technical trends. The report refers to mega trends where new environmental issues have arisen – with an ever increasing demand on natural resources they are being depleted and degraded before we realise it. Besides these reports there is one that stands out in the call for action, aptly titled "Resilient People, Resilient Plant: A future worth choosing" (UN PGS, 2012) it includes Recommendation 39 (Figure 8) which is to develop a SDI by 2014. The recommendation is aligned to the objective to decouple production and consumption from natural resource use and environmental degradation.

The focus then turned to evidence of instruments measuring sustainability at nation state level. The OECD in particular has responded to these appeals and has developed work-in-progress sustainability measurement instruments. One includes a small set of SDIs that reflect stock and flow indicators in two domains, foundational well-being and economic well-being (UNECE, OECD and Eurostat, 2009). UN DESA (2007) has a third edition of SDIs with a core set of 50 indicators which align to Agenda 21 and MDG indicators. Unfortunately these SDIs are not implemented at a global level but concentrate on specific groups like the OECD. van de Kerk and Manual (2008) with their SSI, Prescott-Allen (2001) with the WoN, and the NEF (2012) with their HPI do provide an SDI at a global level and their sustainability elements are included in

addressing research question 2. A theme that did come out in the review is the move towards measuring wellbeing. The OECD with for example their “How’s life? Measuring Well-being” report (OECD, 2012), and another which sets out a compendium of well-being indicators (OECD, 2012a), the World Happiness report developed by the Earth Institute (Sachs *et al*., 2012) all base their measurement indicators on human well-being. Other indicators that have been used over the years by some countries and states include the Genuine Progress Indicator (GPI) (Talberth *et al*., 2006) and its originating ISEW (Daly and Cobb (1994), these two indicators have sound approaches in that they deduct the cost of environmental issues from GDP components, however their implementation has been sparse. The last important SDI report that was reviewed is the most recent, released at RIO+20 – the inclusive wealth report (UNU-IHDP and UNEP, 2012). The authors of this report see the IWI being used in conjunction with the GDP, HDI, EF and ESI over time. It is not clear why they refer to the ESI as it was last published in 2005 (Esty *et al*., 2005), and has subsequently been replaced by the EPI (Emerson *et al*., 2012).

4.2 RESEARCH QUESTION 2

Refer to the research methodology (chapter 3, section 3.2) that specifically applies to this analysis.

The question considers the outcome phase of the literature review where evidence of indices that comprise elements of Sustainability and Sustainable Development are examined. For an index to be selected it needed to have worldwide country level data available in the public domain.

The literature review identified twenty-seven indices that could be considered to have value within the TBL context. Of these, seven where excluded from the final list. The 191 countries are listed in alphabetical order and comprise the complete universe of countries. The final list was separated into four categories in Table 18 (Appendix I), which lists the selected indices in twenty columns:

- Environmental/Planet (Five indices, columns 1 to 5) – The Ecological Footprint (EF), Environmental Performance Index (EPI), Environmental Sustainability Index (ESI), Environmental Well-being (EW) and Ecosystem Wellbeing Index (EWI);
- Social/People (Six indices, columns 6 to 11) – The Human Development Index (HDI), Inequality Adjusted Human Development Index (IHDI), Quality of Life Index (QLI), Gini coefficient (Gini), Human Well-being (HW) and Human Wellbeing Index (HWI).

- Economic/Prosperity (Five indices, columns 12 to 16) – Gross Domestic Product (GDP), Gross National Income per capita (GNI), Adjusted Net Savings (ANS), Global Competitiveness Index (GCI) and Economic Well-being (EcW); and
- Sustainable Development Composites (Four indexes, columns 17 to 20) – Legatum Prosperity Index (LPrI), Happy Planet Index (HPI), Sustainable Society Index (SSI) and Wellbeing Index (WI).

Seven other complementary Sustainable Development indices, not shown in Table 18 (Appendix I), were considered but not included and require an explanation. The seven are the Index of Sustainable Economic Welfare (ISEW), the Genuine Progress Indicator (GPI), the Gross National Happiness Index (GNHI), the Energy Sustainability Index (EneSI), the Your Better Life Index (YBLI), the Inclusive Wealth Index (IWI), and the Living Planet Index (LPI). Neither the ISEW, nor its more recent derivative the GPI, is conducted on a global basis. The GNHI, a recently developed index, was excluded as it too does not have global country data available. The EneSI, which includes 94 countries in the 2012 review, provides a ranking but does not disclose actual scores thereby preventing the opportunity to normalize the data. Given the significant influence that energy, and its concomitant use of non-replenishing natural resources and contribution to global warming, the EneSI would have been a useful index to include. The YBLI is an OECD initiative and therefore, only includes OECD countries. Similarly, the IWI only used 20 countries, including South Africa, in its pilot 2012 index. Lastly, the LPI does not apply to countries, but at a species level.

The indices detail in Table 18 (Appendix I) essentially tells us that there are very few indices that deal with sustainability comprehensively. Only two, the Sustainable Society Index (SSI, 151 countries) and the Wellbeing Index (WI, 181 countries) can be considered in this category. The respective TBL components of these two indices are included separately in the three TBL dimensions. The Happy Planet Index (HPI, 151 countries) follows the sustainability philosophy and also bears specific mention. Evidence of the four figures presented in the response phase of the literature review, Figures 11, 12, 13 and 14, are clearly apparent in all three of these composite SDIs, refer outcomes phase of the literature review for Figure 15 (HPI), Figure 16 (SSI) and Figure 17 (WI). The Legatum Prosperity Index (LPrI) (Legatum, 2012) is the remaining fourth SD composite index. Whilst this index does have composite characteristics it is considered to be skewed towards the Economic/Prosperity and Social/People dimensions, refer to Table 19 (Appendix II) in sub-question 2 for the LPrI elements. Elements of the Environment/Planet dimension are not considered.

Table 18 (Appendix I) also tells us that the organisations that establish their indices do not cover all the 191 countries in the indices universe. Given that data on some counties may be difficult

to obtain, the table shows that the indices range from a high of 187 countries in the Gross National Income (GNI) index, to a low of 111 in the Quality of Life (QLI) index. Data is also unexpectedly missing in certain countries where one would assume it to be reported on, for example, Japan and New Zealand do not have IHDI data available. Figure 19 provides a summary of availability of country specific indices, it tells us that only 79 countries have data for all twenty indices, a further twenty-four countries have nineteen indices, and so on until all 191 countries are accounted for. Puerto Rico – a territory of the United States of America - is the last country in the figure to make up the total of 191 countries. The only organisation to include Puerto Rico is the Global Competitiveness Index (GCI) (WEF, 2012).

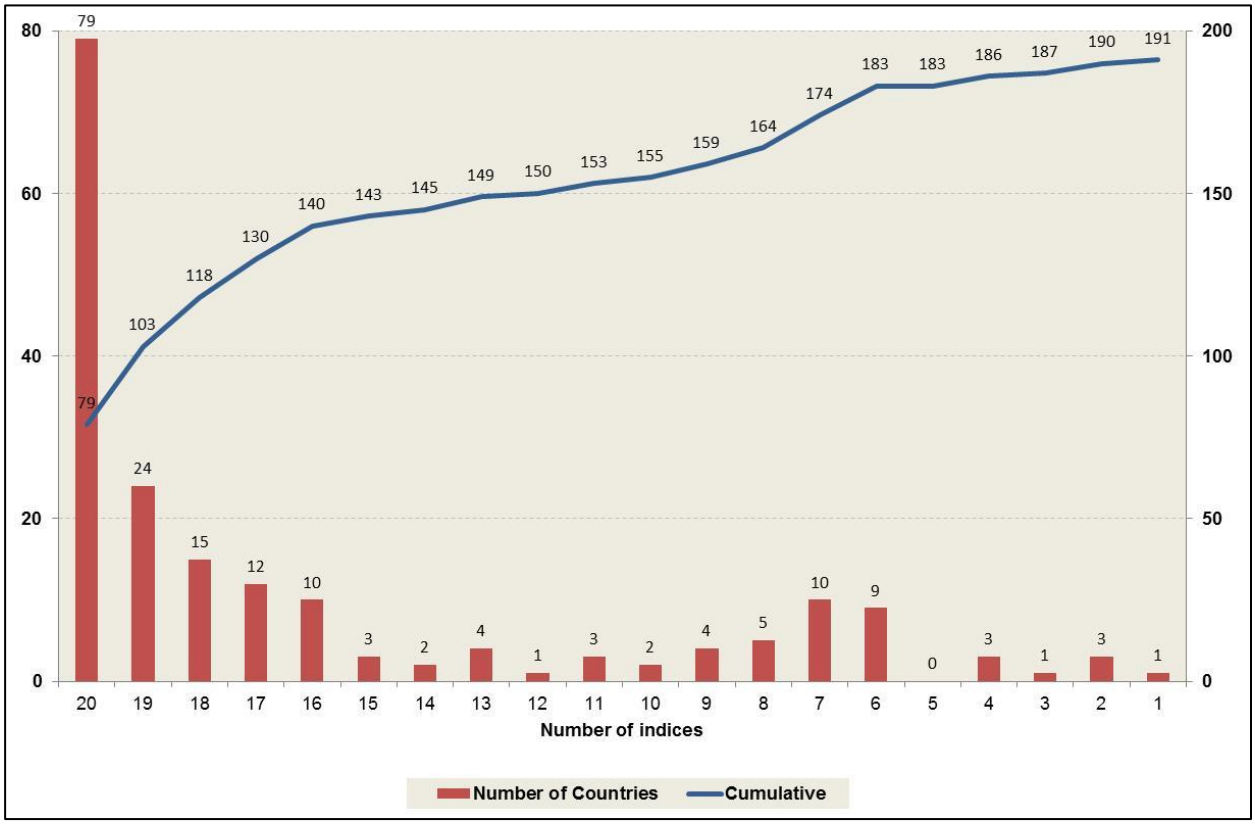


Figure 19: Indices deployment by Country

With the exception of the IHDI, all data is as reflected in the source list at the bottom of Table 18 (Appendix I) and sections 2.7 to 2.11. In the case of the IHDI seven countries were not included in the latest available reported data in the UNDP (2011:135-138), however they are available in the previous year's report (UNDP, 2010:152-155), and were included accordingly. These countries, including South Africa, are shaded darker in Table 18 (Appendix I).

Having determined the indices that comprise Table 18 (Appendix I) the analysis moves to the next stage to produce Table 19 (Appendix II) which provides the details of the answer. In many

respects Table 18 ((Appendix I) acts as the fulcrum between the literature review and the data analysis in that it provides the granular data that is used by research questions 2, 3, 4 and 5.

The twenty indices are listed in matrix fashion. The horizontal row includes an additional section – TBL consolidation of indices - which lists twelve primary sustainability elements. The twelve sustainability elements are mainly based on the Human and Ecosystem dimensions set out by Prescott-Allen (2001) in the Wellbeing of Nations (WoN), refer Figure 17. The five WoN Ecosystem elements (land, water, air, biodiversity, resource use) are accepted as representing the Environment/Planet dimension, whereas for the five WoN Human elements four (health and population, knowledge and culture, community, equity) are placed in the Social/People dimension, with the fifth element (wealth) moved to the Economic/Prosperity dimension. Wealth is then split into the two WoN sub-elements (income, needs) which in turn have indicators for household and National wealth. For example income includes an indicator for GDP, whereas needs include food sufficiency, shelter and basic services like access to safe water and basic sanitation. The Sustainable Society Index (van de Kerk and Manual, 2012a) includes a governance element which is added to the eleven WoN elements, to establish three elements under the Economic/Prosperity dimension.

The vertical column breaks the twenty indices down into their respective elements, totalling 278 elements. A cross reference is then made in this table, which identifies the utilization of sustainability elements. The cross reference takes each of the 278 sustainability elements and transfers them to the “TBL consolidation of indices” section on the right side of the table. In the TBL of indices section a decision is made on where each element resides. The first decision is to identify into which of the three TBL dimensions it belongs - Planet, People, or Prosperity - and then to select the most appropriate category within that TBL dimension. In order to make sense of the detailed grid the 278 sustainability elements are grouped and summarised in Table 13 (section 5.2). This table, which represents the percentage distribution of all twenty indices to the three TBL dimensions, is discussed in the findings chapter (section 5.2).

4.3 RESEARCH QUESTION 3

Refer to the research methodology (chapter 3, section 3.3) that specifically applies to this analysis. This research question sets out to develop a single integrated SDI from the twenty identified indices that comprise Table 18 (Appendix I), and have been used to answer research question 2.

4.3.1 Developing a single integrated SDI

As stated in the research methodology section 3.3 this question is answered in a four step process:

Step 1: Determining the overall universe or sample (see Table 18, Appendix I). This aspect is covered under question 2 (section 4.2).

Step 2: Normalization of data (see Table 20, Appendix III) – This table is derived from Table 18, and is presented in the same country alphabetical order. The values in Table 18 are normalized to produce a common value in percentage terms. Where no value is available a “FALSE” is derived. The individual indices are each conditionally formatted in traffic light colours in order to evaluate, observationally, the top to low country ranking. Six research indices are included to the right of the table which build up to the final column that presents a provisional Global Composite Sustainable Development index (GCSDi). Only countries that have all twenty indices have correctly calculated GCSDi’s. For the remaining 112 (191-79) countries their result is skewed by missing indices. The five Environment/Planet indices are grouped into an Environmental Index (ENVi) via a geometric average of their five normalized scores. The same methodology applies to the six Social/People indices to establish the SOCi, and the five Economic/Prosperity indices to compute the ECOi. These three indices - ENVi, SOCi and ECOi - are then geometrically averaged to determine a single integrated SDI, the TBL index (TBLi) from the sixteen indices. The four sustainable development composite indices are similarly geometrically averaged to compute a Sustainable Development Composite index (SDCi). Finally, the TBLi and the SDCi are geometrically averaged to calculate the singe integrated SDI, the (GCSDi).

Step 3: C3Pi (Table 21, Appendix IV) - As presented in the research methodology it was considered prudent to see whether a more simplified index could be produced that represents each dimension of the TBL. In this way a larger amount of countries would be included. A scan of the organizations that compute the twenty indices resulted in the Environmental Footprint (EF) acting as the representative for the Environment/Planet TBL dimension, the Human Development Index (HDI) representing the Social/People dimension, and the Gross Domestic Product (GDP) the Economic/Prosperity dimension. The combination of these three representative indices reduced the Universe (n=191) to 144 countries, providing a 75.4% universe representation. Using the traffic light principles to re-rank each of the three indices, Table 21 then provides the combined index (C3Pi) on its right, also sorted top to lowest country. The table of 144 countries is divided into four sections in order to group the countries into four equal quadrants. The table also highlights the top country in that index as determined in the

GCSDi (n=79), showing a comparison between South Africa and the top and lowest GCSDi countries.

Step 4: GCSDi (Table 22, Appendix V) – This table is derived from the normalized table, Table 20. All countries that do not have scores for all twenty indices are eliminated. The 79 countries comprise 41.4% of countries in the Universe (79/191). An additional column is inserted for comparison purposes – within the research index section the C3Pi is included amongst the TBLi, SDCi and GCSDi as an additional 27th index and 7th research index. The C3Pi does not get included in the calculation of the GCSDi mentioned earlier.

The end result of this analysis process is the developed single integrated SDI – The GCSDi and or the TBLi.

4.3.2 Demographic analysis

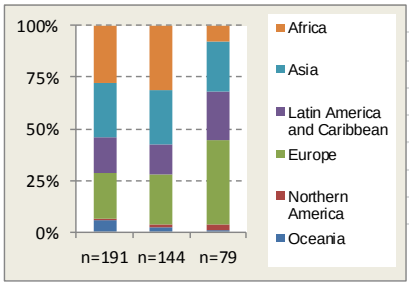
This analysis would be incomplete without using the single integrated SDI to assess nation state performance. Each country was assigned a geographic region, a Planet Earth category (adapted from Ewing *et al*., 2010), an HDI category (UNDP, 2011:127:130), and a Stage of Development (WEF, 2012). From this Table 8 sets out four demographical data sets. This data is then summarized into snapshot stacked bar graphs which emphasis the change in composition between the Universe countries (n=191), the Combined 3 Primary index countries – C3Pi (n=144), and the Global Composite Sustainable Development index – GCSDi (n=79). Ideally one would like to see that the demographics remain constant across the three-levels, thereby providing equal representation in the final GCSDi analysis.

- Region – This shows a trend towards developed regions (countries) increasing their composition as you move from left to right – from Universe to C3Pi to GCSDi. Specifically the European countries – green bar.
- Planet Earth's category – Similar to the region trend, the developed countries have higher percentages as you move to the right, and make up a larger percentage of the final GCSDi. Specifically the two to four Planet Earth's category of countries – red bar.
- HDI category – Again the same trend. Specifically the very high HDI category of countries – blue bar.
- Stage of Development - Again the same trend. Specifically S5: Innovation-driven countries – blue bar.

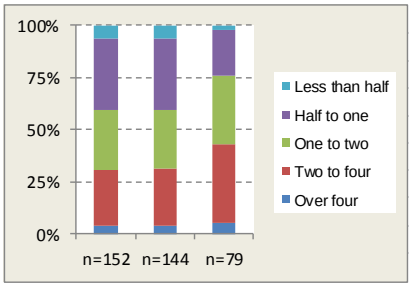
With all four demographical data sets indicating the same trend, where developed counties increase their share of the pie, this could be interpreted as a bias towards them. More probably, it infers that the more developed a country is, the more readily data is available on it, from which the various organizations have developed their indices. As mentioned earlier, one would have hoped that more countries were covered in the GCSDi. This demographical data is further explored in Figure 20 so as to determine whether the smaller GCSDi sample is representative of both the Universe (n=191) and or the C3Pi (n=144).

Table 8: Demographic composition of three-level country data

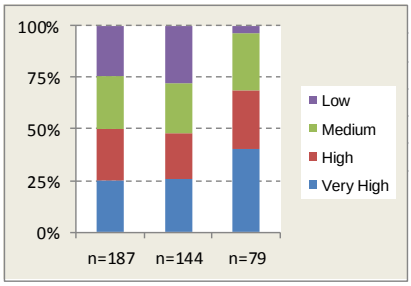
Geographic Region	Universe (n=191)		C3Pi (n=144)		GCSDi (n=79)	
Oceania	11	5.8	3	2.1	1	1.3
Northern America	2	1.0	2	1.4	2	2.5
Europe	41	21.5	35	24.3	32	40.5
Latin America and Caribbea	34	17.8	21	14.6	19	24.1
Asia	50	26.2	38	26.4	19	24.1
Africa	53	27.7	45	31.3	6	7.6
Total	**191**	**100.0**	**144**	**100.0**	**79**	**100.0**



Planet Earth's	Universe (n=152)		C3Pi (n=144)		GCSDi (n=79)	
Over four	6	3.9	6	4.2	4	5.1
Two to four	41	27.0	39	27.1	30	38.0
One to two	43	28.3	41	28.5	26	32.9
Half to one	52	34.2	49	34.0	17	21.5
Less than half	10	6.6	9	6.3	2	2.5
Total	**152**	**100.0**	**144**	**100.0**	**79**	**100.0**
Not included	39					
Universe Total	**191**					



HDI Category	Universe (n=191)		C3Pi (n=144)		GCSDi (n=79)	
Very High	47	25.1	37	25.7	32	40.5
High	47	25.1	32	22.2	22	27.8
Medium	47	25.1	35	24.3	22	27.8
Low	46	24.6	40	27.8	3	3.8
Total	**187**	**100.0**	**144**	**100.0**	**79**	**100.0**
Not listed	4					
Universe Total	**191**					



Stage of Development	Universe (n=191)		C3Pi (n=144)		GCSDi (n=79)	
S5: Innovation-driven	45	26.0	37	25.7	30	38.0
S4: Transition stage 2-3	29	16.8	25	17.4	16	20.3
S3: Efficiency-driven	46	26.6	34	23.6	24	30.4
S2: Transition stage 1-2	15	8.7	12	8.3	5	6.3
S1: Factor-driven	38	22.0	36	25.0	4	5.1
Total	**173**	**100.0**	**144**	**100.0**	**79**	**100.0**
Not given	18					
Universe Total	**191**					

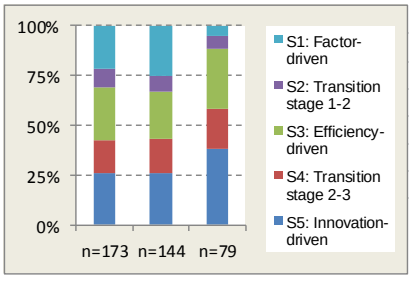


Figure 20 compares firstly, in the left column of graphs, the GCSDi with the C3Pi. The average percentage scores are shown in the bar graphs, and the percentage difference between the two scores is shown as a line graph. In almost all instances the C3Pi scores higher that the GCSDI

and reveals a similar distribution pattern from left (developed) to right (lesser developed), and ranges from a percentage difference of minus 12% (over four planet earth's) to plus 24% (medium HDI category).

Secondly, in the right column of graphs, the Universe is compared to the GCSDi, where the number of countries is displayed in the bar graph, and the percentage of the GCSDi countries to the Universe is represented as a line graph. Again a consistent trend is observed across the four demographical categories, illustrating a similar pattern to that explained in Table 11 where the more developed countries – with higher Planet Earth's, more developed HDIs and better Stages of Development - are better represented between the two data sets. There is quite a strong decline in the Africa region, less than half Planet Earth's, Low HDI and the Factor driven Stage of development, where the representation drops below 25% in all cases. Again, this could be interpreted to mean that the smaller GCSDi sample is somewhat biased towards developed countries. However, the trends are consistent in their declining slopes from left to right - inferring that the GCSDI sample is representative.

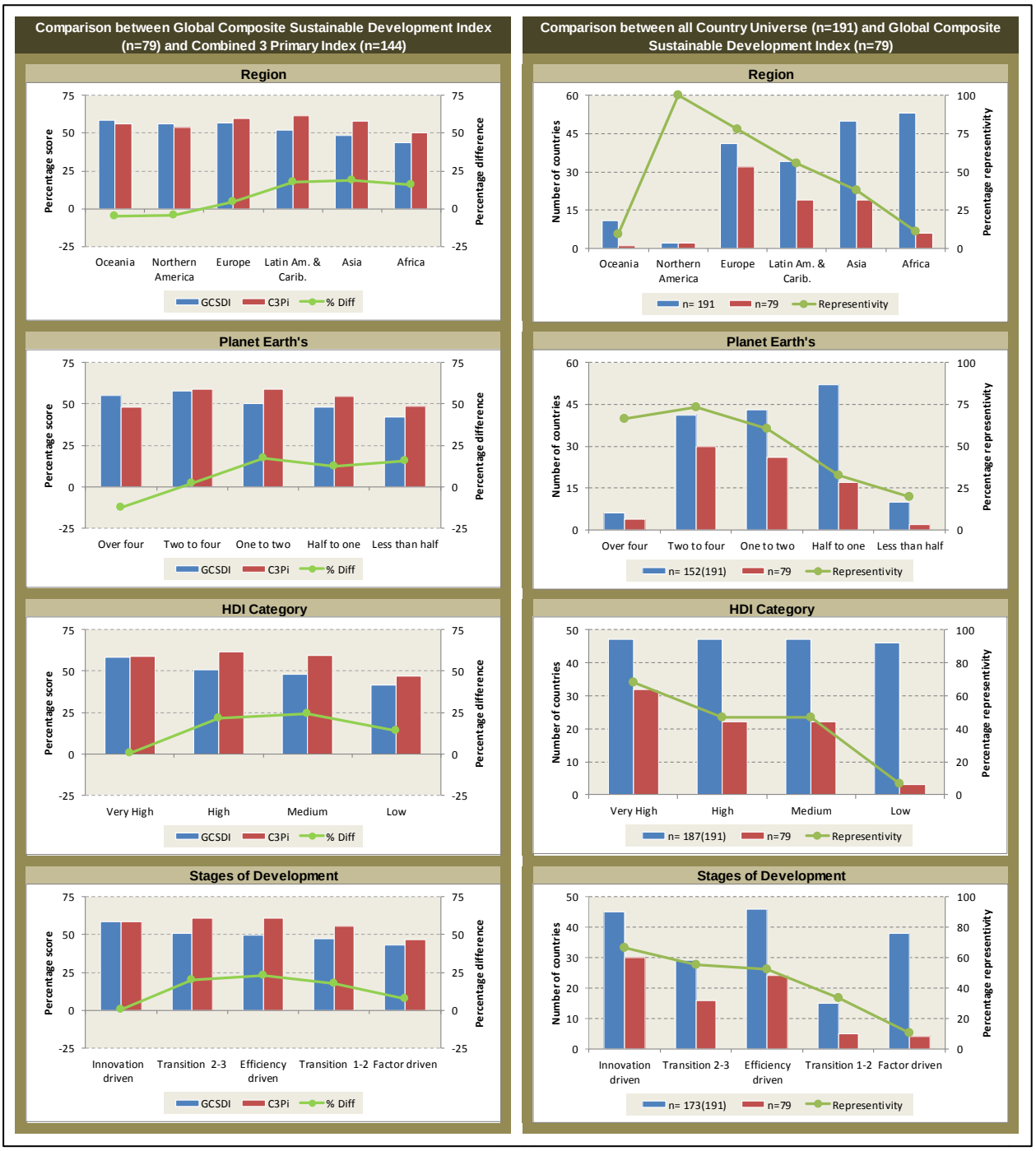


Figure 20: Comparison between three-level country demographics

4.4 RESEARCH QUESTION 4

Refer to the research methodology (chapter 3, section 3.4) that specifically applies to this analysis.

This data analysis consists of two stages. The first is a basic comparison of top and bottom countries in the four research SDIs in Table 9; and the second analyses the all the C3Pi countries in Table 21 (Appendix IV).

The basic review of the research indices considers the variation between the top and bottom countries, including South Africa. Table 9 highlights traffic light snapshots of the top and bottom countries in each of the four respective single integrated SDIs, shown as A: C3Pi, B: TBLi, C: SDCi, and D: GCSDi. A variance (Var.) between the top and bottom values is shown alongside the actual ranked value, from which a percentage variance is computed:

- Combined 3 Primary index (C3Pi), Table 9:A and Table 21 (all 144 countries) – It is interesting to note the top three TBL dimension countries, from Timor-Leste (EF) to Norway (HDI) to Qatar (GDP), which combine into Gabon being top in the C3Pi. The top 21 C3Pi countries perform better than the top GCSDi country, Switzerland, and include many countries that can be considered to be lesser developed with lower Ecological Footprints. Table 9:A shows a significant degree of variation between the dimensions, from a high of 142 (Qatar, 143-1), down to 34 (South Africa, 90-56). Presenting a similar profile to Timor-Leste, the Congo is 6th in the EF, yet bottom in the HDI and GDP, showing a 96.5% variation between top and bottom ranking. This is virtually opposite to the UAE who are 2nd in the GDP, 26th in the HDI, yet bottom in the EF, with a 99.3% variation in ranking. Generally, the table indicates some degree of consistency between the HDI and GDP columns, where these two indices are virtually opposite to the EF indicating a strong discrimination outcome. Only South Africa (23.8%) and Gabon (53.8%) do not show a very big variation between the indices.
- Triple Bottom Line index (TBLi), Table 9:B – Displays a significant degree of variation between the indices, from a high of 78 (Tanzania), down to 18 (Switzerland). Tanzania provides the most extreme case, being top in the ENVi and bottom in the SOCi, besides being second bottom in the ECOi and third bottom overall. Norway features in the top again and presents a far better balance through the indices, as does Switzerland. South Africa presents a consistently poor ranking. In general the table displays a better balance than the C3Pi albeit that the Environment dimension again, presents contradictions or strong discrimination to the other two dimensions.
- Sustainable Development Composite index (SDCi)), Table 9:C - Besides the HPI this table presents a reasonable balance with the top countries in green and the bottom in red. The table shows an improved variation from a high of 63 (Pakistan 80.8%) to a low of 24 (Norway 30.8%).
- Global Composite Sustainable Development index (GCSDi)), Table 9:D - Displays a very good ranking balance across all three indices. The table shows an almost perfect variation

with Switzerland leading both indices, and Pakistan and South Africa trading places at the bottom of the indices.

Table 9: Single Integrated SDIs - Ranking variations

A: C3Pi (n=144)

	Country	EF	HDI	GDP	C3Pi	Var.	% Var.
Top	Timor-Leste	1	108	137	102	136	95.1
	Norway	129	1	3	26	128	89.5
	Qatar	143	29	1	130	142	99.3
	Gabon	42	78	41	1	77	53.8
Last	United Arab Emirates	144	26	2	133	142	99.3
	Congo, Democratic Republic	6	144	144	144	138	96.5
	South Africa	**74**	**90**	**61**	**56**	34	23.8

B: TBLi (n=79)

	Country	ENVi	SOCi	ECOi	TBLi	Var.	% Var.
Top	Tanzania	1	79	78	77	78	100.0
	Norway	32	1	3	3	31	39.7
	Switzerland	19	11	1	1	18	23.1
Last	Belgium	79	8	15	31	71	91.0
	Tanzania	1	79	78	77	78	100.0
	Ghana	14	74	79	78	65	83.3
	South Africa	**68**	**77**	**60**	79	19	24.4

C: SDCi (n=79)

	Country	LPrI	HPI	SSI	WI	SDCi	Var.	% Var.
Top	Norway	1	25	5	2	2	24	30.8
	Costa Rica	27	1	6	29	7	28	35.9
	Switzerland	8	28	1	5	1	27	34.6
	Sweden	3	41	2	1	3	40	51.3
Last	Pakistan	79	16	64	77	79	63	80.8
	Jordan	57	24	79	75	69	55	70.5
	India	75	26	69	79	74	53	67.9
	South Africa	**54**	**79**	**78**	**70**	**78**	25	32.1

D: GCSDi (n=79)

	Country	TBLi	SDCi	GCSDi	Var.	% Var.
Top	Switzerland	1	1	1	0	-
Last	Pakistan	78	79	78	1	1.3
	South Africa	79	**78**	79	1	1.3

To analyse all the countries within the C3Pi (Table 21, Appendix IV) use of the conditionally formatted traffic light system is used to clearly illustrate variations. The 144 countries that comprise this table are ranked for each of the three TBL indices (Ecological Footprint, Human Development Index, Gross Domestic Product), as per their original score. This ranking is conditionally formatted from best country (dark green) through to bottom country (dark red). To the right of the table the three TBL indices are separated from the Combined Primary Index

(C3Pi) which is ranked according to its top to bottom countries. This C3Pi section also displays the normalised values for each of the three TBL indices that are then both averaged and geometrically averaged. The sort being based on the geometric mean. Table 21 shows that South Africa performs much better in the C3Pi, in 56th place and in the upper-middle quadrant.

A more detailed scan of this C3Pi data is to subtract the minimum normalized score from the maximum to determine the degree of variance. For example, Gabon at the top of the C3Pi table has an EF of 67.0, an HDI of 67.4, and a GDP of 72.9, the variance between the maximum and minimum is 5.9 (GDP=72.9 less EF=67.0). This variance for the 144 countries has been summarised in Table 10, where the average variance for the 144 countries is 35.5%. What stands out in this table is the type of countries constituting the top and bottom twenty countries. Essentially lesser-developed countries (8.6% average variance) versus higher-developed countries (67.9% average variance). More glaringly is that Switzerland (59.3%), Norway (66.2%) and Sweden (63.9%) are in the bottom twenty countries, this bearing in mind that they are the top three overall countries in terms of the GCSDi. In terms of this finding or contradiction, it is clear that from a TBL perspective, that none of the three organizations that produce these indices can argue that their index is a genuine marker for Sustainability.

Table 10: C3Pi variations between EF, HDI and GDP scores

Ranked from smallest (top) to largest (bottom) variance between Max & Min								
Top twenty countries			Middle twenty countries			Bottom twenty countries		
Rank	Country	Variance	Rank	Country	Variance	Rank	Country	Variance
1	Gambia	3.1	63	Romania	29.6	125	Czech Republic	59.2
2	Dominican Republic	3.9	64	Panama	29.9	126	Switzerland	59.3
3	Guatemala	4.0	65	Argentina	30.0	127	Burundi	59.7
4	Egypt	5.2	66	Cameroon	30.3	128	Germany	59.8
5	Gabon	5.9	67	Turkmenistan	30.6	129	Singapore	62.1
6	Mauritania	6.1	68	Libyan Arab Jamahiriya	30.9	130	Finland	63.0
7	Algeria	6.2	69	Benin	31.1	131	Sweden	63.9
8	Namibia	7.5	70	Mexico	31.4	132	Estonia	65.3
9	Peru	8.0	71	Senegal	31.8	133	Netherlands	65.9
10	Syrian Arab Republic	8.3	72	Yemen	32.3	134	Ireland	66.2
11	Honduras	9.0	73	Cambodia	32.6	135	Norway	66.2
12	Papua New Guinea	9.3	74	Tajikistan	33.0	136	Congo, Democratic Republ	67.9
13	Nepal	9.9	75	Kenya	33.4	137	Canada	69.2
14	El Salvador	10.7	76	Tanzania	33.7	138	Timor-Leste	69.4
15	Azerbaijan	11.0	77	Lesotho	35.4	139	Australia	70.6
16	Tunisia	11.3	78	Burkino Faso	35.8	140	Belgium	70.8
17	Colombia	12.0	79	Hungary	35.9	141	Denmark	72.6
18	Swaziland	13.0	80	Pakistan	36.3	142	United States of America	73.2
19	Ecuador	13.3	81	Cote d'Ivoire	36.5	143	United Arab Emirates	83.6
20	Jordan	13.4	82	Trinidad and Tobago	36.6	144	Qatar	89.9
	Average	**8.6**		**Average**	**32.8**		**Average**	**67.9**
Average (n=144) = 35.5								
26	**South Africa**	**15.1**						

4.5 RESEARCH QUESTION 5

Refer to the research methodology (chapter 3, section 3.5) that specifically applies to this analysis.

Table 11 provides the correlation coefficient that each of the twenty-seven indices have with one another at country level, this for the 79 countries in the GCSDi. In effect, providing a different opinion from the variation evaluation determined in sub-question 4.5. The top three correlations are the GDP:GNI (0.997), the SDCi:GCSDi (0.984) and the IHDI:SOCi (0.970). The bottom three are the HW:C3Pi (0.001), the EWI:SDCi (0.005) and the EWI:C3Pi (0.011). In order to determine a general ranking order the strength of the correlations are divided into the following four categories:

- Strong (+- 0.75 - 1.0) – Coloured green: The HWI, LPrI, ECOi and the TBLi achieve 15 strong relationships with the 26 other indices (58%), followed by the HDI, the GNI and GCSDi with 14 (54%).
- Moderate (+- 0.5 – 0.75) – Coloured orange: The EcW has 17 moderate relationships (65%), followed by the EPI with 14 (54%).
- Weak (+- 0.25 – 0.5) – Coloured yellow: The Gini has 16 weak relationships (62%), followed by the EWI and the SSI with 14 (54%).
- No linear association (+- <0.25) – Coloured red: Significantly, both the ANS and the C3Pi have no relationships in 23 cases (88%), which is very evident observationally with their red columns and rows.

Table 11: Coefficient of Correlation Matrix of 27 Indices

		ENVIRONMENT / PLANET					SOCIAL / PEOPLE						ECONOMIC / PROSPERITY					COMPOSITES				RESEARCH INDEXES						
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Extra 27	21	22	23	24	25	26
		Ecological Footprint	Environmental Performance Index	Environmental Sustainability Index	Environmental Well-being	Ecosystem Wellbeing Index	Human Development Index	Inequality-adjusted HDI	Quality of Life Index	Income Gini coefficient	Well-Human being	Human Wellbeing Index	Gross Domestic Product per capita	Gross National Income per capita	Adusted Net Savings	Global Competitiveness Index	Economic Well-being	Legatum Prosperity Index	Happy Planet Index	Sustainable Society Index	Wellbeing Index	Combined 3 Primary Index	Environment Index	Society Index	Economic Index	Trople Bottom Line Index	Sustainable Development Composite Index	Global Composite Sustainable Development Index
		EF	EPI	ESI	EW	EWI	HDI	IHDI	QLI	Gini	HW	HWI	GDP	GNI	ANS	GCI	EcW	LPrI	HPI	SSI	WI	C3Pi	ENVi	SOCi	ECOi	TBLi	SDCi	GCSDi
CORRELATION COEFFICIENT: r																												
ENVIRONMENT / PLANET	EF	1.000	-0.574	-0.511	0.580	0.343	-0.900	-0.866	-0.682	-0.378	-0.808	-0.867	-0.903	-0.899	0.176	-0.677	-0.617	-0.822	0.467	-0.216	-0.709	0.315	0.627	-0.816	-0.790	-0.643	-0.591	-0.628
	EPI		1.000	0.567	0.062	0.068	0.661	0.635	0.676	0.289	0.661	0.691	0.625	0.627	0.048	0.474	0.573	0.653	0.062	0.730	0.760	0.054	0.097	0.653	0.646	0.828	0.810	0.838
	ESI			1.000	-0.050	0.298	0.520	0.483	0.484	0.210	0.466	0.526	0.492	0.500	-0.097	0.387	0.524	0.574	-0.070	0.486	0.720	-0.071	0.125	0.482	0.510	0.665	0.644	0.669
	EW				1.000	0.559	-0.599	-0.610	-0.372	-0.415	-0.612	-0.569	-0.603	-0.601	0.107	-0.450	-0.296	-0.465	0.407	0.413	-0.274	0.078	0.898	-0.595	-0.475	-0.217	-0.130	-0.169
	EWI					1.000	-0.334	-0.330	-0.275	-0.160	-0.324	-0.349	-0.379	-0.378	-0.046	-0.377	-0.081	-0.289	0.188	0.299	0.207	0.011	0.792	-0.319	-0.296	0.026	0.005	0.013
SOCIAL / PEOPLE	HDI						1.000	0.965	0.807	0.461	0.906	0.953	0.959	0.961	-0.099	0.728	0.656	0.875	-0.228	0.306	0.804	0.033	-0.555	0.927	0.859	0.805	0.764	0.801
	IHDI							1.000	0.756	0.614	0.942	0.945	0.908	0.908	-0.063	0.723	0.666	0.871	-0.301	0.313	0.799	-0.033	-0.563	0.970	0.840	0.820	0.733	0.787
	QLI								1.000	0.340	0.761	0.846	0.815	0.823	0.046	0.730	0.555	0.873	0.048	0.375	0.726	0.045	-0.361	0.796	0.764	0.753	0.834	0.823
	Gini									1.000	0.636	0.510	0.415	0.411	0.031	0.381	0.428	0.463	-0.289	0.163	0.441	-0.161	-0.343	0.728	0.447	0.550	0.328	0.425
	HW										1.000	0.928	0.884	0.881	-0.038	0.714	0.644	0.850	-0.300	0.337	0.784	0.001	-0.533	0.961	0.821	0.825	0.720	0.781
	HWI											1.000	0.937	0.940	-0.057	0.762	0.661	0.917	-0.272	0.346	0.845	-0.035	-0.538	0.949	0.859	0.826	0.788	0.824
ECONOMIC / PROSPERITY	GDP												1.000	0.997	-0.108	0.749	0.647	0.857	-0.271	0.292	0.761	0.041	-0.589	0.887	0.877	0.771	0.715	0.756
	GNI													1.000	-0.084	0.770	0.658	0.870	-0.256	0.300	0.765	0.042	-0.585	0.887	0.889	0.779	0.731	0.769
	ANS														1.000	0.139	0.280	0.015	0.192	0.297	-0.086	0.074	0.090	-0.033	0.276	0.175	0.122	0.146
	GCI															1.000	0.522	0.850	-0.156	0.243	0.581	-0.107	-0.499	0.726	0.790	0.643	0.674	0.678
	EcW																1.000	0.640	-0.175	0.669	0.644	-0.036	-0.242	0.670	0.886	0.805	0.668	0.741
COMPOSITES	LPrI																	1.000	-0.179	0.357	0.793	-0.159	-0.467	0.876	0.836	0.785	0.852	0.847
	HPI																		1.000	0.166	-0.176	0.517	0.473	-0.271	-0.187	-0.029	0.233	0.135
	SSI																			1.000	0.532	0.185	0.424	0.334	0.533	0.735	0.664	0.709
	WI																				1.000	-0.030	-0.109	0.808	0.728	0.878	0.826	0.868
RESEARCH INDEXES	C3Pi																					1.000	0.2500	-0.043	0.021	0.166	0.160	0.168
	ENVi																						1.000	-0.535	-0.457	-0.096	-0.051	-0.071
	SOCi																							1.000	0.835	0.849	0.747	0.808
	ECOi																								1.000	0.867	0.776	0.833
	TBLi																									1.000	0.894	0.960
	SDCi																										1.000	0.984
	GCSDi																											1.000

STRENGTH OF LINEAR RELATIONSHIP (number of r values)																												%
Strong: +- (0.75-1.0)	9	4	0	1	1	14	13	12	0	13	15	13	14	0	4	2	15	0	0	12	0	2	13	15	15	9	14	29.9
Moderate: +- (0.5-0.75)	11	14	12	9	1	6	7	5	5	7	6	6	6	0	12	17	3	1	7	7	1	8	7	4	5	10	5	25.9
Weak: +- (0.25-0.5)	4	2	8	9	14	3	4	6	16	4	3	5	4	3	6	3	5	10	14	2	2	8	4	5	0	1	1	20.8
No linear association	2	6	6	7	10	3	2	3	5	2	2	2	2	23	4	4	3	15	5	5	23	8	2	2	6	6	6	23.4
Total	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	100.0
Weighted points (3:2:1:0)	53	42	32	30	19	57	57	52	26	57	60	56	58	3	42	43	56	12	28	52	4	30	57	58	55	48	53	42.2
Weighted points %	67.9	53.8	41.0	38.5	24.4	73.1	73.1	66.7	33.3	73.1	76.9	71.8	74.4	3.8	53.8	55.1	71.8	15.4	35.9	66.7	5.1	38.5	73.1	74.4	70.5	61.5	67.9	54.1

In order to determine one value for relationship strength, the four categories were weighted strong (number of strong relationships times a factor of 3), moderate (times a factor of 2), and weak (times a factor of 1), refer Table 11. Given that the maximum score is 78 (number of correlations above 75% times three, that is, 26 times 3) Figure 21 is divided into three layers of 26 points accumulated. The bottom layer up to 26 weighting points (0-33.3%), the middle third up to 52 points (66.7%), and the top layer of 26 up to 78 points (100%).This indicates that the WoN's HWI has the best overall relationship with the other 26 indices, scoring 60 weighting points (76.9%), followed by the GNI and ECOi research index with 58 points (74.4%). The ANS (3 points, 3.8%) and the C3Pi (4 points, 5.1%) deliver virtually no relationships. Figure 21 sorts this into a ranking order. Interestingly, whilst the WoN's HWI has the best overall relationship, its parallel index the EWI is fourth last with only 19 weighting points (24.4%) – together they score 52 (66.7%) in the WI composite, which resides exactly in the middle of the ranking order. On the right hand side the three TBL dimensions, the SD composites, and the research indices are grouped and averaged. The far right shows the average weighting points for all 27 indices is 42.2 (54.1%). The single integrated SDIs are highlighted, indicating that the TBLi and GCSDi are in the top third layer at 70.5% and 67.9% respectively, whereas the C3Pi is second bottom of the bottom third layer, at 5.1% with 4 points.

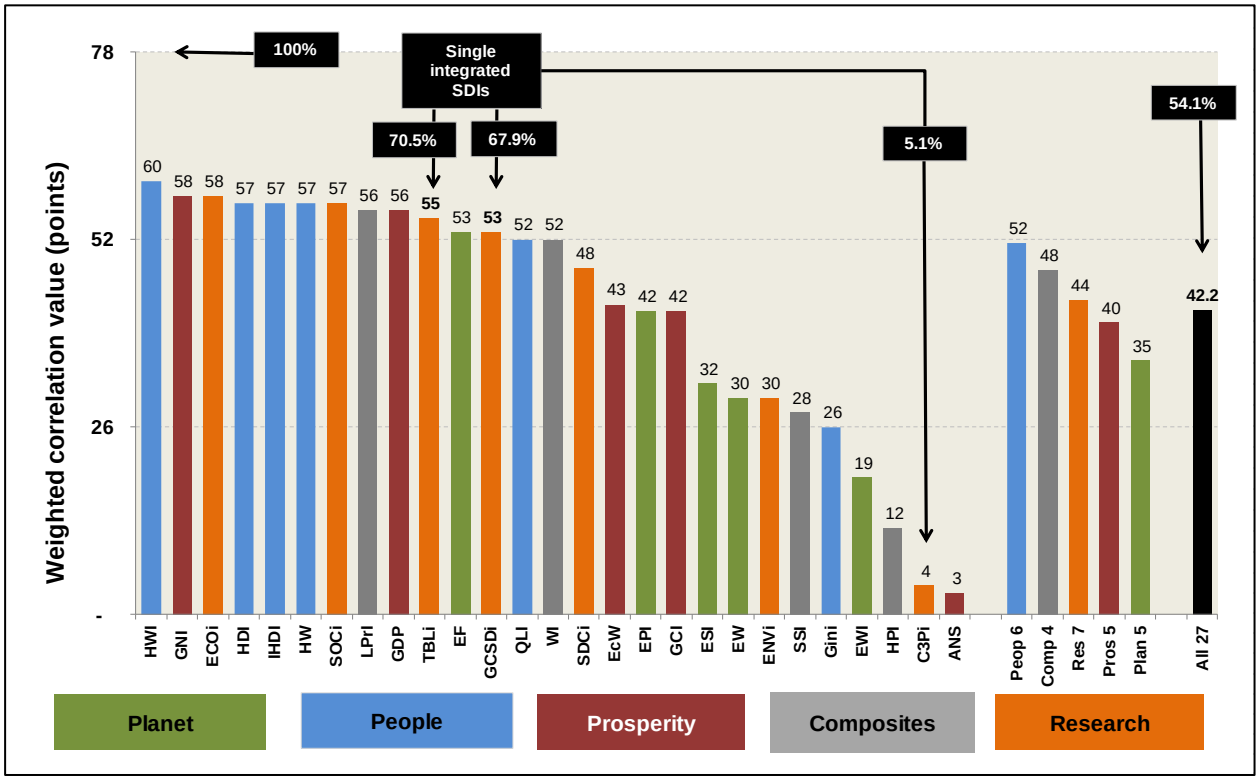


Figure 21: Correlation summary - Weighted points

A more detailed look at this information is illustrated in Figure 22, where the top graph shows the percentage breakdown of the four correlation strength categories for each of the 27 indices.

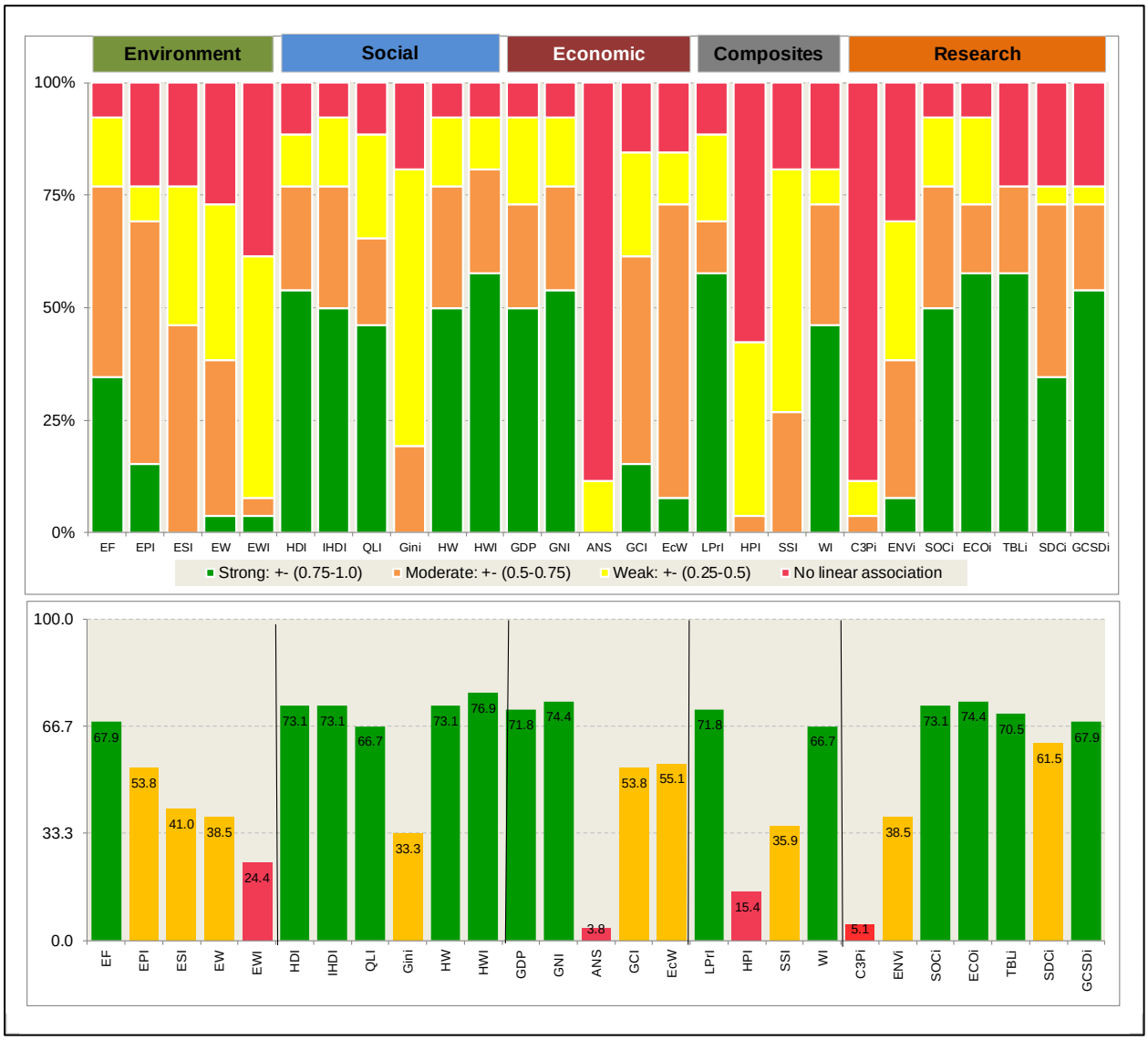


Figure 22: Indices correlation strength and weighted correlation strength

Starting with the strong category in green at the bottom, the stacked bar adds the three next categories until a 100% is reached. The two extremes are clear, firstly the HWI has 21 (81%) of the 26 other indices above a correlation of 50% (green 15 and moderate 6); and secondly, the ANS has no green and moderate correlations, and reveals 100% of the 26 other indices below the 50% correlation line, made up of weak (yellow 3 indices) and no relationship (red 23). The bottom bar graph lines up with the top graph and illustrates the overall weighted points for each of the 27 indices as a percentage. As described above, with maximum weighting points of 78 the graph is divided into three layers. The bottom layer (0-33.3%, up to 26 weighting points) shows these indices red; the middle third up to 52 points (66.7%) shows these indices amber; and the top layer of 26 up to 78 points (100%) shows these indices green. This shows the following:

- The Social/People dimension has the best correlations overall with 5 out of 6 indices in green (HDI, IHDI, QLI, HW, HWI), the only outlier the Gini, is a marginal amber.

- The next best group are the research indices with 4 green (SOCi, ECOi, TBLi, GCSDi), 2 amber (ENVi and SDCi) and 1 red, the extreme outlier C3Pi.
- The third group is the Economic/Prosperity dimension with 2 green (GDP, GNI), 2 amber (GCI, EcW), and 1 red, the lowest correlation index the ANS.
- Then the composite indices have 2 greens (LPrI, WI), 1 amber (SSI) and 1 red (HPI).
- The Environment/Planet dimension displays the lowest correlation performance, with only 1 green (EF), 3 amber (EPI, ESI, EW), and 1 red (EWI).

This indicates that perhaps the EF (67.9%), HWI (76.9%) and GNI (74.4%) should have constituted the C3Pi (EF, HDI and GDP), being the best correlated indices within their respective TBL dimensions. The pie graph in Figure 23 shows the summarised correlation spread in percentage terms, where the strong category has the highest percentage of correlations (29.9%), followed by the moderate category (25.9%), the no relationship (23.4%) and the weak (20.8%).

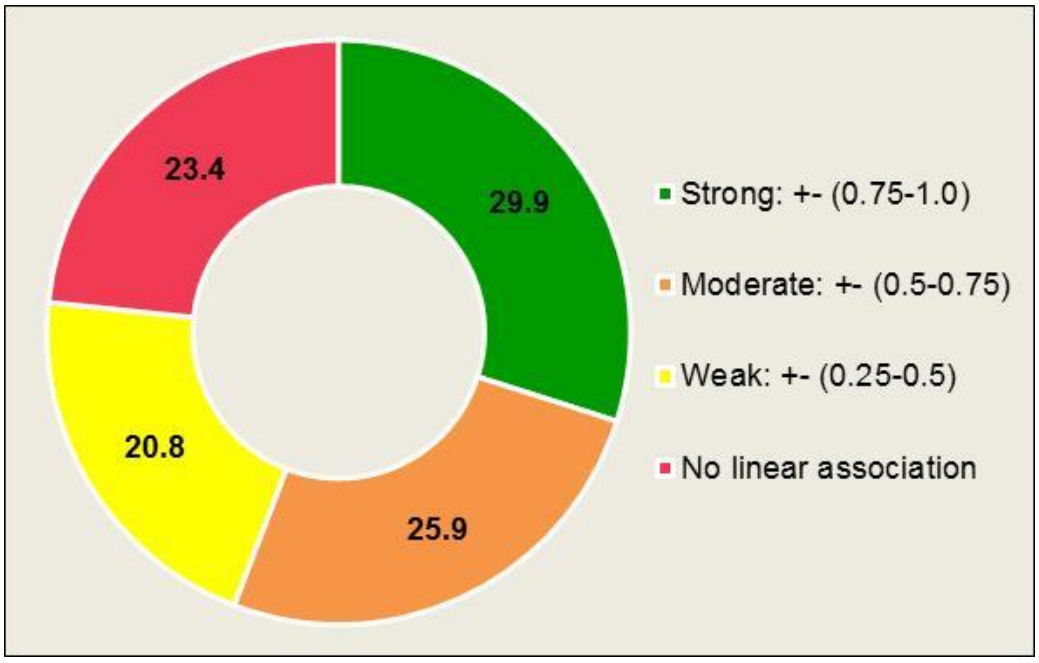


Figure 23: Summarised correlation strength – Percentage spread

An analysis to compare indices within their own dimensions was undertaken so as to see whether the final research indices present a consistent overall result. The coefficient of determination, r^2, represents the per cent of the data that is closest to the line of best fit and measures how well the regression line represents the data. R^2 is used to predict future outcomes based on related information and is more informative when interpreting the magnitude of the relationship between two variables, regardless of directionality. The higher the value of r^2 the better. As an example, using the correlation coefficient of the TBLi:GCSDi of 0.960, we see that this indicates a very strong positive relationship between the TBLi and

GCSDi for the 79 countries. The r^2 of 0.921 (0.960 x 0.960) tells us that 92.1% of the variation in the TBLi can be accounted for by the variation in the GCSDi, meaning that 7.9% of the variation is attributed to other factors.

The coefficient of determination was computed for the twenty indices where each was expressed against their respective research index, for example the four Environmental/Planet indices are expressed against the ENVi and then averaged. Four categories are set – Very good (0.81 - 1.00), that is the square of a coefficient of correlation value of 0.9; Good (0.5625 – 0.81), the square of 0.75; Moderate (0.25 – 0.5625), the square of 0.50; and Poor (<0.25). Figure 24 illustrates the results:

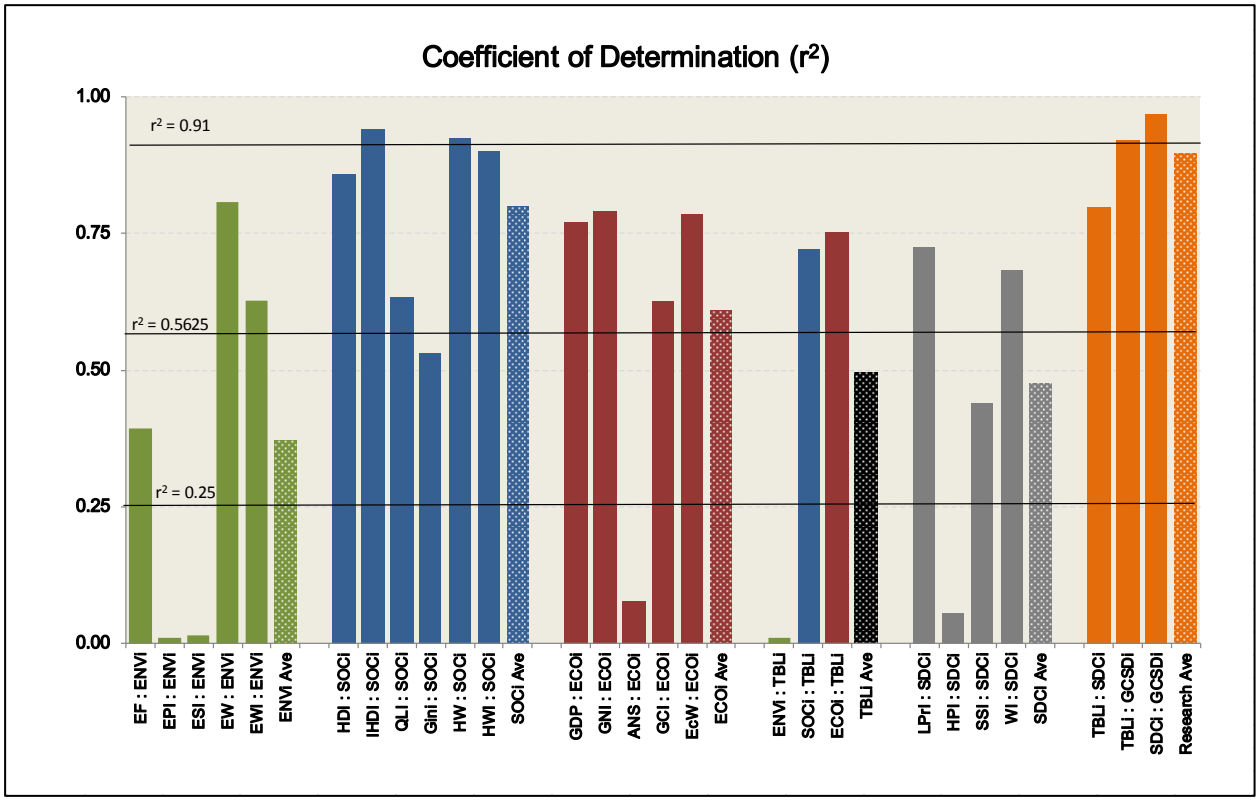


Figure 24: Indices Coefficient of Determination within own dimension

- Environment/Planet (ENVi: green) – Two good results are achieved from the EW (80.7%) and the EWI (62.7%). The EF (39.3%) is moderate. Both the EPI (0.9%) and ESI (1.6%) are poor. The average of the five is 37.0%.
- Social/People (SOCi: blue) – Two out of the six achieve a very good result via the IHDI (94.2%) and HW (92.4%). Three obtain a good result, the HDI (85.9%), the HWI (90.0%) and the QLI (63.3%). The last one, the Gini (53.0%) is moderate. The average of the six is 79.8%.
- Economic/Prosperity (ECOi: red) – Four out of five achieve a good result, the GDP (76.9%), the GNI (79.0%), the GCI (62.5%), and the EcW (78.5%). The ANS (7.6%) is poor. The average of the five is 60.9%.

- Triple Bottom Line (TBLi) – Two of the three TBL dimensions achieves a good result, the ECOi (red, 75.2%) and the SOCi (blue, 72.2%). The ENVi is particularly poor achieving (green, 0.9%), which reduces the average of the three to 49.4%.
- Sustainable Development Composites (SDCi: grey) – Two good results are achieved from the four indices, the LPrI (72.5%) and the WI (68.3%). The SSI (44.0%) is moderate and the HPI (5.4%) is poor. The average of the four is 47.6%.
- Research Indices (orange) – Two very good results are achieved by the SDCi:GCSDI (96.8%) and the TBLi:GCSDi (92.1%). The third, the TBLi expressed against the SDCi achieves a good result with 79.9%. The average of the three is 89.6%.

4.6 RESEARCH QUESTION 6

Refer to the research methodology (chapter 3, section 3.6) that specifically applies to this analysis.

Bearing in mind the intentions of both the Constitution (1996) and the NEMA (107/1998), and given that the NFSD (DEAT, 2008) sets out the principles to serve as a compass to ensure South Africa's development path in a sustainable manner, it is deemed necessary to get a perspective on the country' sustainability performance according to locally published information. Contextually, the Resilient Planet, Resilient People report was co-chaired by President Zuma (UN PGS, 2012). This report includes Recommendation 39, indicating that his leadership in the development of SDIs that decouple production and consumption from natural resource use and environmental degradation should develop within the South African planning and policy frameworks.

The literature review found good evidence of initiatives endevouring to manage and measure South Africa's sustainability. Whilst a thread can be drawn between the National Framework for Sustainable Development (NFSD) (DEAT, 2008) and the National Strategy for Sustainable Development (NSSD1) (DEA, 2011), this does not flow seamlessly into the recently released National Development Plan (NPC, 2012). Although the NDP has a chapter (chapter 5) on Environmental Sustainability, which states "By 2030, South Africa's transition to an environmentally sustainable, climate-change resilient, low-carbon economy and just society will be well under way", it is silent on the NFSD and the NSSD per se. There is no clarity in the NDP on how to measure the "will be well under way". The NDP emphasis is socio-economic, poverty elimination and addressing inequality. With this specific socio-economic focus the best indicator going forward, on which to benchmark progress, will be the IHDI which includes features of both the HDI and the Gini coefficient. There is some reference to sustainability issues in the previously released Development Indicators report (The Presidency, 2011), which one would

have expected to be outcomes of the NDP. So, it will be interesting to see the next release of these Development Indicators. Curiously, the NSSD1 does not form a vital building block of the NDP, especially bearing in mind the vision, principles and pathways set out in the NFSD -Table 2, which are endorsed by the NSSD1 – Table 3.

Besides the NFSD, and hence the NSSD1, if one looks more closely at sustainability one sees that it is referred to more prominently in environmental legislation and related public documentation. The endeavour to incorporate the ESI (Esty *et al.*, 2005), (Table 6 – Environmental Sustainability Indicators Technical Report), methodology is a good example of this. This in turn will inform the next SOER, which does make use of the DPSIR (Figure 10) methodology. It is in the latest SOER (DEAT, 2006) that the best presentation of South Africa's sustainability is illustrated. Table 5 was adapted from the "at a glance scorecard" of the SOER and is now looked at more closely. Importantly human issues play a key role, for example settlements and vulnerability, within the SOER scorecard. Taken together with the six environmental aspects, the SOER in effect, resembles a two dimensional score of the TBL. In order to quantify Table 5 the 55 indicators have been tabulated in Table 12.

Table 12: SOER 2006 Performance Dashboard

	Moving in right direction	No improvement / uncertain trend	Cause for concern	Total Indicators	Indicators Percentage Distribution			
SOER 2006 Key Findings / Aspect								Total
Environmental governance	1	4	2	7	14.3	57.1	28.6	100
Land	1	4	1	6	16.7	66.7	16.7	100
Biodiversity & ecosystem health	1	0	6	7	14.3	0.0	85.7	100
Inland water	0	0	5	5	0.0	0.0	100.0	100
Marine & coastal resources	2	0	5	7	28.6	0.0	71.4	100
Atmosphere	2	2	8	12	16.7	16.7	66.7	100
Human settlements	1	2	4	7	14.3	28.6	57.1	100
Human vulnerability	0	2	2	4	0.0	50.0	50.0	100
Average	**8**	**14**	**33**	**55**	**14.5**	**25.5**	**60.0**	100
TBL Dimension								
Environment/Planet	7	10	27	44	15.9	22.7	61.4	100
Social/People	1	4	6	11	9.1	36.4	54.5	100

(Source: Adapted from DEAT, 2006)

The Table 12 matrix indicates the performance of the eight environmental aspects on one dimension, and the three performance categories on the other. It reveals a concerning picture overall, with 60% of the indicators red and only 14.5% green, a 4.1 times multiple. In the TBL dimension summary the Environment/Planet dimension indicates that 15.9% is green with 61.4% red, and the Social/People dimension has only 9.1% green with 54.5% red.

The stacked bar graph (Figure 25) summarises Table 12 and illustrates the performance of the eight aspects on a three level scale ranging from green, to amber, to red. Inland water (100% red) indicates a serious cause for concern.

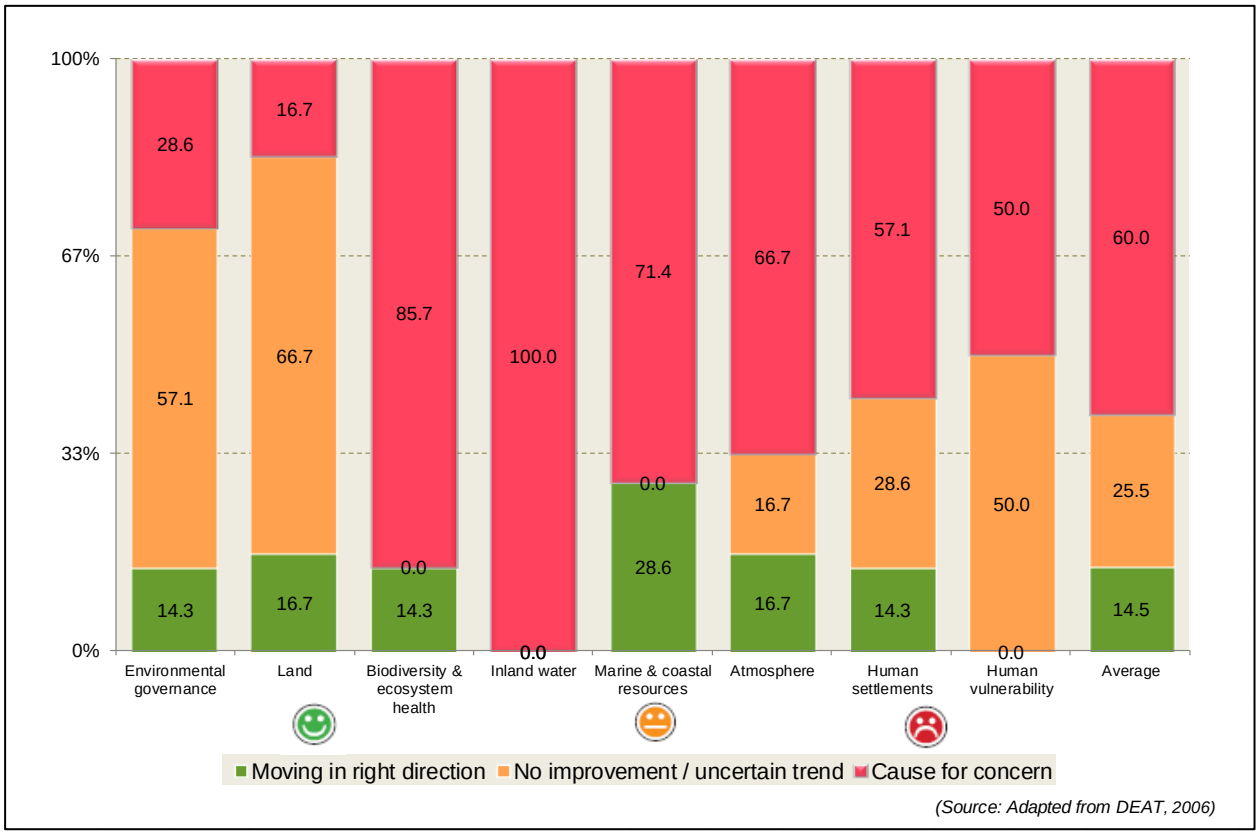


Figure 25: SOER 2006 - Eight Aspects Performance

Given the relevance of the NDP (NPC, 2012) and its focus on reducing inequality and eliminating income poverty (see Figure 18) it is prudent to consider South Africa's Gini coefficient within the context of a world position. Firstly, the individual nation states Gini coefficients (CIA, 2012) are listed in Table 18 and show that the highest four are South Africa (.650, second highest), and three of its neighbours – Namibia (.707, highest), Lesotho (.632), and Botswana (.630). This clarifies the focus of the NDP (NPC, 2012). Secondly, the Human Development Report (UNDP, 2010:73) notes that the consideration of Global inequality is a traditional position of the Human Development Reports, and that a fundamental point is that "income inequality among the world's population is very high", with one study finding that the world Gini coefficient has worsened since 1988 and "now stands at a startling 0.71". Whilst they note that the world Gini is subject to critique, it does reveal that the world Gini is about as poor as that of the highest country. This infers that as far as South Africa is concerned, the problem is Global, regional and local.

CHAPTER 5: DISCUSSION ON FINDINGS

This chapter is structured in relation to the six research questions as described in chapter 1, section 1.3 and Table 1. Structuring the findings in line with the data analysis as well as in relation to the different research questions aims to demonstrate that the six research questions have been successfully answered.

5.1 RESEARCH QUESTION 1

The sub-problem is: Review the scope of global sustainability related indices that measure nation states. Its corresponding research question is: What is the scope of the global indices in dealing with sustainability related dimensions of the TBL? The finding is broadened to integrate the results of research question 3 (section 4.3).

These findings are headed under the most important aspects that were found under the broad sustainability scope which needed to be dealt with in order to deal with the more granular detail within indices.

5.1.1 No common global scale Sustainable Development Index

The literature review found that there is no one SDI that is commonly used by UN countries to measure sustainability in terms of the TBL dimensions on a global and regular basis. It is clear from the literature that needs to be considered alongside and given at least the same importance as the GDP.

5.1.2 Limits to growth and sustainability

The fundamental but difficult conversation around limits to growth, as described by Meadows *et al.* (2004), and the effect that human activity is having on the Earth system, as described by Steffen *et al.* (2004), is not evident in the final results. MacNeill (2012) also alludes to this oversight by the Brundtland (1987) Commission. Bearing this in mind - that there are natural resource constraints - an essential finding in this research is that only the EF, and to a lesser degree the HPI, meets this test. Neither the SSI nor WI deal with threshold limits. This argument therefore finds that HPI is the most useful composite SDI.

The subtle difference in the message that both Meadows *et al.* (2004) and Steffen *et al.* (2004) convey, is that they do not consider political or geographical boundaries; they consider the whole system - the Planet. The only index that aptly depicts this world-view is the LPI (WWF, 2012), the output of which is vividly illustrated in Figure 5. The Living Planet Index is only measured from 1970, and the rapid deterioration over this brief period is staggering – 30 per cent. In their supplement to the LPI report (WWF, 2012), the WWF prepared a parallel report for RIO+20 (WWF, 2012a). In this report they categorically state their commitment to the development of "clear and measurable indicators that allow for the monitoring of progress", refer Figure 4. Al Gore refers to this planetary emergency in his book titled "An Inconvenient Truth" (Gore, 2006). Gore's title fittingly encapsulates the WWF summary illustrated in Figure 26 (WWF, 2012a).



Figure 26: Business as Usual Projections – Two Planets by 2030

5.1.3 Focus on socio-economic measurement

From a global perspective it is evident, from both the review and analysis phases, that socio-economic issues are the priority. Twenty years on from the Rio Earth Summit in 1992, with the UN's agreement to Agenda 21 (UN CED, 1992), no established method to measure sustainability exists. Whilst recommendation 39 (UN PGS, 2012), the Inclusive Wealth Report (UNU-IHDP and UNEP, 2012) with its IWI outcome, and Stigliz *et al.* (2010) provide three recent

examples of concentrated endeavours to address this measurement of sustainability, it is inconceivable that in a world where everything is measured, no recognized method to benchmark the sustainability of nations exists.

5.1.4 Policy makers and informed decision making

In order to make informed decisions policy makers require good and better information. The plethora of indices all state their case to be seriously considered by policy decision makers, but the analysis leads one to ask the question: Who do I believe? Or which data do I use?

The different, and in many instances, contradicting results are not doing policy makers a favour. Besides the data being overwhelming, the finding is that data can be manipulated through selective indices to achieve a desired yet contrasting result. For policy makers that want one answer, this contradictory information is providing them with mixed messages.

This opportunity or ability to produce contradictory or variable results that can be manipulated into a desired output is most likely the most serious impediment to the development of a SDI that is both comprehensive of the three TBL dimensions, and also acceptable to all stakeholders. Two recent endeavours to measure SD, of which the United Nations has been a part of, are the proposed set of SDIs (UNECE, OECD and Eurostat, 2009) in Table 2 and the IWI (UNU-IHDP, 2012). These two different approaches have the potential to reveal contradictory or variable results and give an indication of the different points of view in reaching a consensus methodology referred to in Recommendation 39(UN PGS, 2012).

It is interesting to note the political awareness of Kennedy (1968) forty-five years ago to measure what matters, and state that the GDP methodology is fundamentally flawed. Four years later decision makers at the UN Stockholm conference (Dodds *et al.*, 2012:123) expressed concern of the threat human activity is to the planet. A further ten years later the Rio Earth Summit established Agenda 21 (UN CED, 1992), and ten years later again the WSSD in 2002 reconfirmed policy-makers intentions. Yet, a further ten years elapse leading up to Rio+20 where the main finding by the SD21 is “we need a renewed political deal”. The many documents released for RIO+20, the GEO-5 (UNEP, 2012), the Keeping track (UNEP, 2011), the Measuring progress (UNEP, 2012a), the Future we want (UN, 2012b), the Back to our common future (UN DESA, 2012), the Inclusive Wealth Report (UNU-IHDP and UNEP, 2012) etcetera all confirm this renewed political deal. This is encapsulated in the Resilient People Resilient Planet report (UN PGS, 2012) which outlines 56 recommendations including recommendation 39 (Figure 8), which aims to develop an SDI by 2014.

Essentially, the overall finding reveals that there is no commonly used single integrated SDI, and that growth thresholds are rarely considered.

5.2 RESEARCH QUESTION 2

The sub-problem is: discover the extent to which they (sustainability related indices) integrate sustainability elements. Its corresponding research question is: To what extent do the indices integrate sustainability elements? The data analysis of this question is contained in section 4.2.

Whilst this outcomes phase found no evidence of any one commonly used global SDI, there are a number of indices that contain sustainability elements which can be integrated to develop a single SDI. Three organisations in particular have taken up the call for SDIs and their literature has been very useful in informing the empirical part of the study.

The data analysis of this question is contained in section 4.2. The findings are tabulated in Table 13 which condenses the three dimensions (people, planet, prosperity) into a group titled the Trilemma Indices, where the word Trilemma is taken from the World Energy Council (2012) who compiles the Energy Sustainability Index (EneSI).

Table 13: Integration of sustainability elements – Percentage distribution

			Twenty indices	Planet	People	Prosperity	Total
Environment / Planet	1	EF	Ecological Footprint	100.0	-	-	100.0
	2	EPI	Environmental Performance Index	53.0	8.3	38.7	100.0
	3	ESI	Environmental Sustainability Index	45.9	9.6	44.6	100.0
	4	EW	Environmental Well-being	100.0	-	-	100.0
	5	EWI	Ecosystem Wellbeing Index	100.0	-	-	100.0
Social / People	6	HDI	Human Development Index	-	60.0	40.0	100.0
	7	IHDI	Inequality-adjusted HDI	-	60.0	40.0	100.0
	8	QLI	Quality of Life Index	7.9	39.5	52.6	100.0
	9	Gini	Income Gini coefficient	-	100.0	-	100.0
	10	HW	Human Well-being	-	42.9	57.1	100.0
	11	HWI	Human Wellbeing Index	-	38.5	61.5	100.0
Economic / Prosperity	12	GDP	Gross Domestic Product per capita	-	-	100.0	100.0
	13	GNI	Gross National Income per capita	-	-	100.0	100.0
	14	ANS	Adjusted Net Savings	-	-	100.0	100.0
	15	GCI	Global Competitiveness Index	-	34.9	65.1	100.0
	16	EcW	Economic Well-being	-	-	100.0	100.0
SD Composites	17	LPrI	Legatum Prosperity Index	-	42.3	57.7	100.0
	18	HPI	Happy Planet Index	33.3	33.3	33.3	100.0
	19	SSI	Sustainable Society Index	33.3	33.3	33.3	100.0
	20	WI	Wellbeing Index	33.3	33.3	33.3	100.0

Summary	Planet	People	Prosperity	Total
Environment / Planet	79.8	3.6	16.7	100.0
Social / People	1.3	56.8	41.9	100.0
Economic / Prosperity	-	7.0	93.0	100.0
Trilemma Indices	27.0	22.4	50.5	100.0
SD Composites	25.0	35.6	39.4	100.0
Average Trilemma & SD Composites	26.0	29.0	45.0	100.0

Whilst Table 13 finds that the majority of the individual twenty indices are heavily biased towards their respective TBL dimensions it is worth noting that besides the three composite indices (HPI, SSI WI), the EPI, ESI and QLI are the only ones that span all three TBL dimensions. The ESI is almost equally shared between Planet (45.9%) and Prosperity (44.6%). Although the Environment/Planet (79.8%) and the Economic/Prosperity (93.0%) dimensions display big percentage shares within their own dimensions, the Social/People dimension includes a significant Economic stake (41.9%). The Trilemma Indices and SD Composites distributions both reveal the Economic dimension as taking the largest segment, 50.5% and 39.4% respectively, with a reversal in the next largest share between the remaining two dimensions.

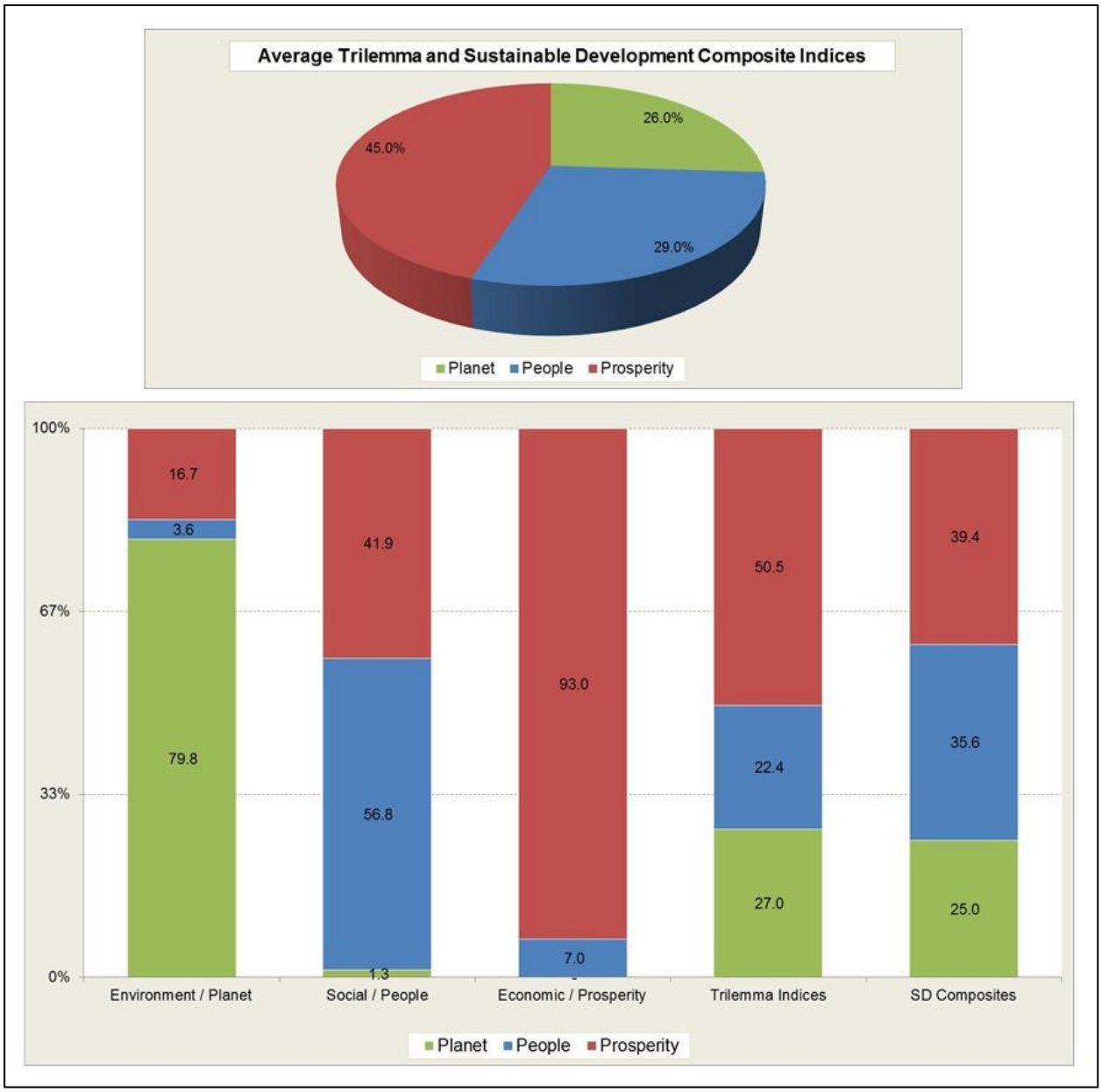


Figure 27: Integration of sustainability elements – TBL Proportions

The findings are summarised in Figure 27. The bar graph provides the breakdown of the pie graph where the Economic/Prosperity dimension makes up 45% of the pie, followed by Social/People 29% and lastly Environment/Planet 26%. This finds the extent to which they integrate sustainability elements. Although care has been taken in selecting the twenty indices the overall result is consistent with the literature in that it reveals that the Economic dimension dominates, followed by the Social and Environment components. In essence, this presents an inverse relationship to the nested egg diagram used in the National Sustainable Development Framework (DEAT, 2008), Figure 1, and implies that the outer shell is the Economy and the inner shell ecosystem services, with socio-political remaining in the middle.

Essentially, the overall finding reveals that the twenty indices do integrate sustainability elements.

5.3 RESEARCH QUESTION 3

The sub-problem is: establish whether a single integrated SDI can be developed. Its corresponding research question is: How can a single integrated SDI be derived from the global indices? The data analysis of this question is contained in section 4.3.

By using the methodology techniques described in section 3.3 the data analysis proceeded to produce an integrated SDI that benchmarks all the nation states that were constituents of the twenty basic indices (n=79). A choice of SDI is provided by either including the composite indices to obtain the GCSDI or exclude them to obtain the TBLi. The findings that the single integrated SDIs produce are discussed in terms of geographic performance and nation state benchmark performance.

5.3.1 Geographic performance

Figure 28 gives a continental perspective of the findings and colours all countries according to a six level threshold continuum. All the countries that did not have sufficient data for the twenty indicators are shaded grey, which besides developed countries like Japan and New Zealand (19 out of 20 indices), highlights the extent to which African countries standout. Northern Europe (light green), specifically Switzerland and Norway (dark green), reveal the extent to which they lead the world in the GCSDi single integrated SDI, essentially best performers in both Sustainable Development and human well-being. The Scandinavian countries in particular show the best overall performance. Generally speaking, the findings illustrate that besides Africa the America's lie in the middle (yellow), and Eastern Europe and Asia fall below 50% (pink). The breakdown of the six thresholds is as follows:

- Dark Green (70% - 80%) – 2 countries, 2.5% overall: Switzerland and Norway;
- Light Green (60% - 70%) – 7 countries, 8.9% overall;
- Amber (50% - 60%) – 40 countries, 50.6% overall;
- Pink / Light Red (40% - 50%) – 27 countries, 34.2% overall;
- Dark Red (30% - 40%) - 3 countries, 3.8% overall: Tanzania, Pakistan and South Africa;
- Grey – Insufficient data.

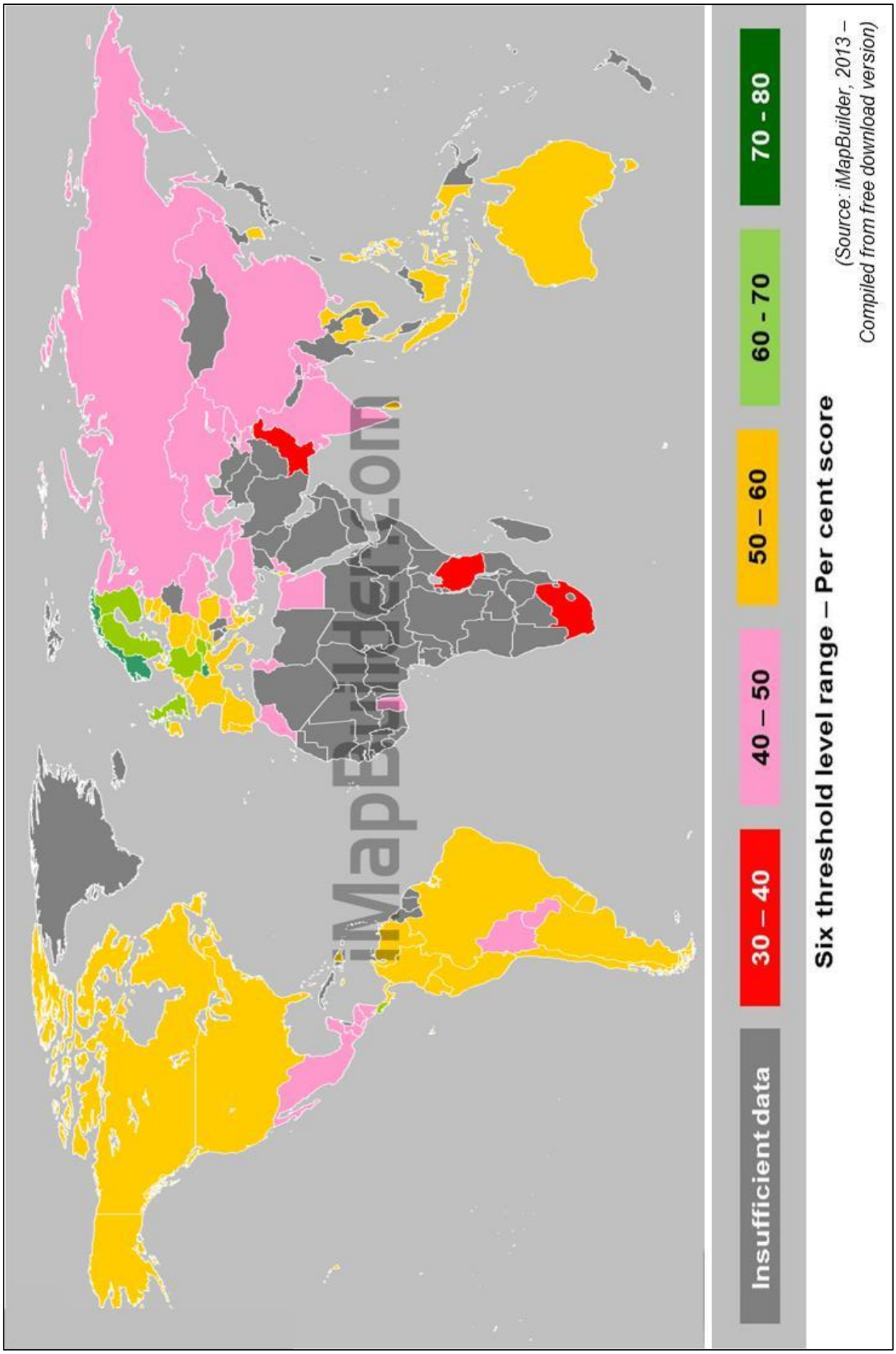


Figure 28: World Map of single integrated index results (GCSDi)

Figure 29 provides a regional variation perspective of the world map. The six regions are sorted on the basis of their highest country performance (green) from left to right, from Europe to Africa, with the World mean separate on the far right. The mean of each region is shown in yellow, and the lowest country within each region in red. Although the bar graph re-emphasises the extent to which Europe leads the GCSDi, Africa's top country (Tunisia) is ahead of Europe's worst (Macedonia). Oceania is only represented by Australia. The percentage variation between top and bottom countries within each region is represented by the blue dot on the secondary axis, and finds that Europe has a variance of 37.5%, whereas Africa is 21.9%. This indicates that although Europe is the leading region, it also has adverse regional results.

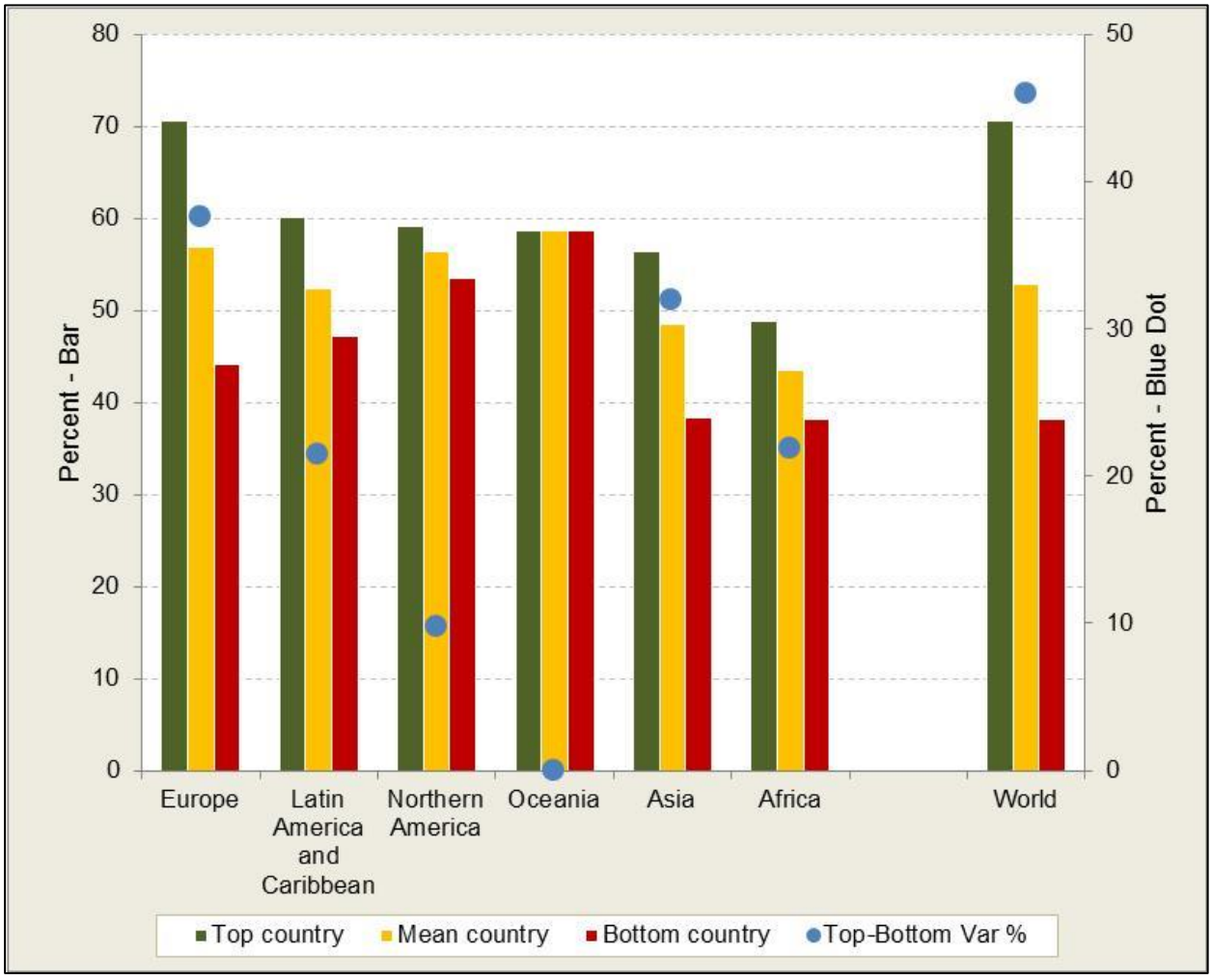


Figure 29: Regional GCSDi variation performance

5.3.2 Nation State SDI benchmark performance

The following tables and figures summarise what the indices tell us:

- Table 14, final results summary by country and finds that the:

- ENVi - the ENVi has the worst performance in terms of sustainability. With no country in dark green, one country, Tanzania light green, 55 amber, and 23 in red.
- SOCi – the SOCi is represented by 11 dark green, 27 light green, 38 amber, and 3 red.
- ECOi - the ECOi has 3 dark green, 40 light green, 36 amber, and importantly no red.
- TBLi – 12 (15%) light green and 67 (85%) amber, and no red.
- SDCi – 9 (11%) light green, 64 (81%) amber, and 6 (8%) red.
- GCSDi - Overall, when reviewing the final result, the GCSDi, comprises no dark green, 9 (11%) light green, 3 (4%) red, and the vast majority (67 – 85%) amber; implying mediocre sustainability.
- South Africa is the only country with 2 reds and 1 amber in the three TBL dimensions.

Table 14: Final Results Summary by Country

Quadrant	Rank	Country	ENVi	SOCi	ECOi	TBLi	SDCi	GCSDi
Top quadrant	1	Switzerland	51.1	80.0	84.3	70.1	71.2	70.7
	2	Norway	47.0	87.0	80.5	69.1	70.9	70.0
	3	Sweden	48.5	86.0	80.8	69.6	69.4	69.5
	4	Austria	47.4	82.3	77.2	67.0	66.9	66.9
	5	Finland	45.0	83.2	76.7	66.0	65.4	65.7
	6	Germany	42.7	81.2	73.8	63.5	63.1	63.3
	7	United Kingdom	41.6	75.2	68.5	59.8	61.9	60.9
	8	Slovenia	42.6	78.5	72.9	62.5	58.2	60.3
	9	Costa Rica	56.4	56.5	62.2	58.3	62.0	60.1
	10	France	41.4	77.3	68.1	60.2	59.7	59.9
	11	Denmark	35.0	83.9	77.5	61.0	58.7	59.9
	12	Netherlands	35.2	80.5	75.0	59.6	59.7	59.7
	13	Canada	37.8	79.7	66.4	58.5	60.0	59.2
	14	Italy	41.8	77.5	67.4	60.2	57.5	58.9
	15	Australia	33.6	81.1	73.6	58.5	58.9	58.7
	16	Slovakia	45.5	75.0	71.7	62.6	55.0	58.7
	17	Czech Republic	37.7	75.9	73.4	59.5	55.1	57.2
	18	Argentina	48.5	60.5	62.9	57.0	56.8	56.9
	19	Uraguay	47.0	62.2	65.4	57.6	55.5	56.6
	20	Ireland	35.9	80.0	61.7	56.2	56.9	56.5
Upper-middle quadrant	21	Korea (South)	35.5	75.0	73.8	58.2	54.7	56.4
	22	Spain	35.1	77.1	67.8	56.8	55.4	56.1
	23	Latvia	49.3	67.4	70.0	61.5	51.2	56.1
	24	Panama	49.1	54.5	65.9	56.1	55.9	56.0
	25	Poland	39.9	70.6	67.7	57.6	54.4	56.0
	26	Portugal	42.0	71.6	59.4	56.3	54.2	55.3
	27	Sri Lanka	59.0	53.4	56.5	56.3	54.0	55.1
	28	Belgium	31.0	80.5	71.5	56.3	53.9	55.1
	29	Peru	55.9	54.2	60.5	56.8	52.9	54.8
	30	Hungary	43.5	75.9	62.7	59.2	50.6	54.7
	31	Lithuania	46.1	68.1	66.8	59.4	50.2	54.6
	32	Croatia	45.3	70.3	65.4	59.3	49.8	54.4
	33	Ecuador	55.6	53.9	56.6	55.4	51.9	53.6
	34	Brazil	51.2	52.1	58.2	53.7	53.3	53.5
	35	Chile	41.9	57.9	60.6	52.8	54.3	53.5
	36	United States of America	33.9	70.6	62.7	53.1	53.8	53.5
	37	Albania	57.7	60.1	54.0	57.2	49.5	53.2
	38	Colombia	56.4	48.9	56.2	53.7	52.6	53.2
	39	Israel	33.9	68.5	69.3	54.4	51.8	53.1
	40	Indonesia	54.2	53.2	54.2	53.8	51.8	52.8
Lower-middle quadrant	41	Estonia	34.0	71.1	72.3	55.9	49.1	52.4
	42	Dominican Republic	53.0	51.8	57.0	53.9	50.8	52.3
	43	Romania	41.9	64.8	65.6	56.3	47.8	51.8
	44	Viet Nam	51.2	50.9	52.2	51.4	52.2	51.8
	45	Thailand	45.1	52.3	62.2	52.7	50.8	51.8
	46	Venezuela	47.7	56.7	55.9	53.2	50.0	51.6
	47	Philippines	48.9	53.7	56.6	53.0	49.6	51.3
	48	Greece	38.2	74.6	54.1	53.6	48.5	51.0
	49	Jamaica	46.0	57.6	50.4	51.1	50.7	50.9
	50	Armenia	51.1	60.9	52.0	54.5	45.6	49.9
	51	Mexico	38.8	53.9	65.4	51.5	48.1	49.8
	52	El Salvador	49.2	50.5	53.0	50.9	48.5	49.7
	53	Bulgaria	40.6	62.3	61.1	53.7	45.5	49.4
	54	Georgia	52.0	57.4	47.8	52.2	46.1	49.1
	55	Tunisia	42.4	56.1	60.5	52.4	45.6	48.9
	56	Paraguay	50.9	46.3	52.4	49.8	47.8	48.8
	57	Nicaragua	58.1	46.2	45.9	49.8	47.8	48.8
	58	Honduras	53.2	41.6	52.8	48.9	48.0	48.4
	59	Kyrgyzstan	51.0	53.6	45.8	50.0	46.2	48.1
	60	Moldova	45.2	54.7	54.3	51.2	45.1	48.1
Bottom quadrant	61	Bolivia	56.4	42.0	51.8	49.7	46.3	48.0
	62	Turkey	38.9	57.1	62.2	51.7	44.1	47.8
	63	Guatemala	53.8	39.2	52.2	47.9	46.6	47.3
	64	China	39.8	46.7	65.3	49.5	45.0	47.2
	65	Russian Federation	39.7	57.5	59.6	51.4	42.4	46.7
	66	Morocco	43.1	50.0	55.4	49.2	44.0	46.6
	67	Azerbaijan	41.5	58.0	58.6	52.1	41.4	46.4
	68	Ukraine	37.2	62.7	55.9	50.7	41.8	46.0
	69	Bangladesh	52.1	45.8	47.3	48.3	43.8	46.0
	70	Kazakstan	33.2	62.5	56.0	48.8	41.6	45.1
	71	Egypt	45.3	55.8	52.6	51.0	39.5	44.9
	72	Tajikistan	45.9	49.7	44.2	46.5	42.5	44.5
	73	Jordan	36.9	55.4	49.9	46.7	41.9	44.3
	74	Macedonia	39.0	55.7	61.2	51.1	38.2	44.1
	75	India	44.1	46.8	52.4	47.7	39.8	43.5
	76	Ghana	52.9	42.3	41.3	45.2	40.5	42.8
	77	Tanzania	61.6	38.1	41.5	46.0	34.2	39.7
	78	Pakistan	49.2	42.3	47.3	46.2	31.9	38.4
	79	South Africa	36.8	39.6	53.5	42.7	34.2	38.2

- Table 15, final results summary by grouping shows the benchmarked performance of four specific groupings in the world, together with a fifth regional leadership group. Their respective sustainability performance provides a different perspective to the data.

  Africa - The results reflect only six African countries (11 per cent of the continent), and shows the three North African countries outperforming the remaining three including South Africa.

  BRICS[1] countries – this association of emerging national economies show that only Brazil has no red score below 40 per cent. The ENVi is the standout poor performer. Across the three TBL dimensions there are no dark greens, 1 (6.7%) light green (China, ECOi), 10 ambers (66.7%) and 4 red (26.7%).

  Group of 8 (G8[2]) countries –The European countries of Germany and the United Kingdom are clear leaders, with the two cold war protagonists the United States of America and the Russian Federation bringing up the rear. Japan does not have an IHDI value and is, therefore, not a constituent of the GCSDi. It is clear that the G8 needs to include the importance of the environmental dimension which shows a contrasting picture of poor performance.

  G20[3] - Besides Japan, Saudi Arabia is also excluded from the GCSDi non IHDI reasons and the European Union is not a country and has not been grouped for analysis. Again, it is clear that if this is where global leadership issues take place, sustainability per se, and environmental issues specifically, should be on the agenda.

  Regional leaders - From a regional perspective the leading countries of each region are benchmarked to determine the degree of variation. This finds that Europe (Switzerland) provides clear leadership in terms of sustainability performance with Latin America and the Caribbean (Costa Rica) second, closely followed by North America (Canada), Oceania (Australia) and Asia (South Korea). Africa (Tunisia) is the only region below 50%. Also refer Figures 28 and 29.

  A final summary of the groupings provides an overall snapshot of the sustainability performance of the important global leadership groupings. The region leaders reflect the best overall performance (59%) followed by the G8 countries (57.5%). The G20 countries

[1] Brazil, Russia, India, China and South Africa.
[2] The G8 dates back to the 1970s and represents an informal grouping of advanced industrialised economies that meet annually to discuss matters of political and economic importance (USDS, 2013).
[3] Established in 1999 the Group of Twenty Countries, represented by their Finance Ministers and Central Bank Governors together with representatives of the International Monetary Fund and the World Bank, bring together systematically important industrialised and developing economies of which South Africa and their BRICS counterparts are included (Kirton, 1999).

(53.4%) closely resemble the 79 GCSDi countries (52.8%), as do the BRICS countries (45.8%) and the African region 43.5%. South Africa (38.2%) is benchmarked against these groupings.

South Africa is seen as the leader on the continent in many respects, besides being the only African country in the BRICS group it is the only African representative in the G20.

Essentially, the overall finding reveals that a single integrated SDI has been developed and that it has been used to benchmark the sustainability performance of 79 countries.

Table 15: Final Results Summary by Groupings

	Rank	Country	ENVi	SOCi	ECOi	TBLi	SDCi	GCSDi
AFRICA	55	Tunisia	42.4	56.1	60.5	52.4	45.6	48.9
	66	Morocco	43.1	50.0	55.4	49.2	44.0	46.6
	71	Egypt	45.3	55.8	52.6	51.0	39.5	44.9
	76	Ghana	52.9	42.3	41.3	45.2	40.5	42.8
	77	Tanzania	61.6	38.1	41.5	46.0	34.2	39.7
	79	South Africa	36.8	39.6	53.5	42.7	34.2	38.2
BRICS	34	Brazil	51.2	52.1	58.2	53.7	53.3	53.5
	64	China	39.8	46.7	65.3	49.5	45.0	47.2
	65	Russian Federation	39.7	57.5	59.6	51.4	42.4	46.7
	75	India	44.1	46.8	52.4	47.7	39.8	43.5
	79	South Africa	36.8	39.6	53.5	42.7	34.2	38.2
G8 Countries	6	Germany	42.7	81.2	73.8	63.5	63.1	63.3
	7	United Kingdom	41.6	75.2	68.5	59.8	61.9	60.9
	10	France	41.4	77.3	68.1	60.2	59.7	59.9
	13	Canada	37.8	79.7	66.4	58.5	60.0	59.2
	14	Italy	41.8	77.5	67.4	60.2	57.5	58.9
	36	United States of America	33.9	70.6	62.7	53.1	53.8	53.5
	65	Russian Federation	39.7	57.5	59.6	51.4	42.4	46.7
		Japan						
G20 Countries	6	Germany	42.7	81.2	73.8	63.5	63.1	63.3
	7	United Kingdom	41.6	75.2	68.5	59.8	61.9	60.9
	10	France	41.4	77.3	68.1	60.2	59.7	59.9
	13	Canada	37.8	79.7	66.4	58.5	60.0	59.2
	14	Italy	41.8	77.5	67.4	60.2	57.5	58.9
	15	Australia	33.6	81.1	73.6	58.5	58.9	58.7
	18	Argentina	48.5	60.5	62.9	57.0	56.8	56.9
	21	Korea (South)	35.5	75.0	73.8	58.2	54.7	56.4
	34	Brazil	51.2	52.1	58.2	53.7	53.3	53.5
	36	United States of America	33.9	70.6	62.7	53.1	53.8	53.5
	40	Indonesia	54.2	53.2	54.2	53.8	51.8	52.8
	51	Mexico	38.8	53.9	65.4	51.5	48.1	49.8
	62	Turkey	38.9	57.1	62.2	51.7	44.1	47.8
	64	China	39.8	46.7	65.3	49.5	45.0	47.2
	65	Russian Federation	39.7	57.5	59.6	51.4	42.4	46.7
	75	India	44.1	46.8	52.4	47.7	39.8	43.5
	79	South Africa	36.8	39.6	53.5	42.7	34.2	38.2
		Japan						
		Saudi Arabia						
		Eurpopean Union						
REGIONS LEADER	Switzerland	Europe	51.1	80.0	84.3	70.1	71.2	70.7
	Costa Rica	Latin America and Caribbean	56.4	56.5	62.2	58.3	62.0	60.1
	Canada	Northern America	37.8	79.7	66.4	58.5	60.0	59.2
	Australia	Oceania	33.6	81.1	73.6	58.5	58.9	58.7
	Korea (South)	Asia	35.5	75.0	73.8	58.2	54.7	56.4
	Tunisia	Africa	42.4	56.1	60.5	52.4	45.6	48.9
SUMMARY	Regions leader (6 Countries)		42.8	71.4	70.1	59.3	58.7	59.0
	G8 (7 Countries)		39.8	74.1	66.6	58.1	56.9	57.5
	G20 (17 Countries)		41.2	63.8	64.0	54.8	52.1	53.4
	GCSDi (79 Countries)		45.1	61.9	61.1	54.9	50.9	52.8
	BRICS (5 Countries)		42.3	48.5	57.8	49.0	42.9	45.8
	Africa (6 Countries)		47.0	47.0	50.8	47.8	39.7	43.5
	South Africa		36.8	39.6	53.5	42.7	34.2	38.2

5.4 RESEARCH QUESTION 4

The sub-problem is: Appraise the single integrated SDI to ascertain the extent to which nation state global indices vary with one another in order to determine what a comparison may reveal. Its corresponding research question is: What is the extent of variations between the indices? The data analysis of this question is contained in section 4.4.

Table 10, section 4.4 found significant variations between top and bottom countries within the four research indices. Taking the focus into the main single integrated SDI, the GCSDi Table 16 presents the variation findings for the top and bottom countries for all twenty-seven indices. A good example of these findings is the contradiction that Tanzania presents, it is bottom in eight indices, the HDI, IHDI, QLI, HW, GDP, GNI, EcW and SOCi, yet it is top in the EW.

The granular detail of these overall variability findings are tabulated in Table 22 (Appendix V) on the traffic light conditionally formatted basis, where the general finding is the starkly contrasting patterns of data in the observational trends. The Environmental/Planet indices are opposite to the Social/People and Economic/Prosperity indices. The best view of this is to compare columns 21 to 23, the ENVi to the SOCi and ECOi. However even within the three TBL indices there are variations and contradictions – the EF for example stands out being different from the EPI, ESI, EW and EWI. The same trend is evident with the ANS in the Economic/Prosperity indices when compared to the GDP, GNI, GCI and EcW. Within the SD Composites the HPI is the contradicting index compared to the LPrI, SSI and WI. Table 23 (Appendix VI) is another version of Appendix V and ranks each country for each index from 1 to 79. It clearly shows how well Switzerland and Norway performed, each ranking first in eight indices, whereas Tanzania ranked last in eight indices. Conversely, the EF is the top ranked index for nine countries and also the lowest ranked for eleven countries, showing the largest contrasting variation.

Essentially, the overall finding reveals that there are significant variations in both the indices themselves but also the countries.

Table 16: Summary of GCSDi Countries

Dimmension	Indices	Top country	Bottom country	Maximum (top) score	Minimum (bottom)	Mean (average)	South Africa	Std Dev	Median
Environment / Planet	EF	Bangladesh	Denmark	90.3	16.9	46.3	52.9	17.9	46.6
	EPI	Switzerland	Kazakstan	76.7	32.9	55.7	34.6	9.4	56.5
	ESI	Finland	China/Tajikistan	75.1	38.6	52.4	46.2	8.0	50.9
	EW	Tanzania	Australia	83.4	20.0	41.7	29.6	14.1	38.6
	EWI	Bolivia	Spain	63.0	20.0	37.7	27.0	9.7	36.0
Social / People	HDI	Norway	Tanzania	94.3	46.6	75.1	61.9	11.8	74.4
	IHDI	Norway	Tanzania	89.0	33.2	63.3	41.1	15.2	63.7
	QLI	Ireland	Tanzania	83.3	45.0	62.9	52.5	9.1	62.2
	Gini	Norway	South Africa	89.4	10.8	52.4	10.8	18.6	53.9
	HW	Norway	Tanzania	94.4	46.9	73.1	62.2	12.7	70.4
	HWI	Norway	Tanzania/Pakistan	82.0	18.0	52.7	43.0	17.7	49.0
Economic / Prosperity	GDP	Norway	Tanzania	92.9	38.3	69.4	68.0	14.1	70.6
	GNI	Norway	Tanzania	88.3	37.0	66.6	65.2	13.3	66.9
	ANS	China	Greece	100.0	43.6	64.4	53.4	10.1	63.7
	GCI	Switzerland	Argentina	81.7	43.9	62.5	62.4	8.4	61.7
	EcW	Switzerland	Tanzania	86.3	24.6	48.0	29.6	15.4	45.0
Composites	LPrI	Norway	Pakistan	100.0	11.1	56.3	43.3	21.1	49.9
	HPI	Costa Rica	South Africa	77.9	23.0	55.1	23.0	12.2	56.4
	SSI	Switzerland	Jordan	73.6	35.5	51.7	39.1	6.9	51.4
	WI	Sweden	India	64.0	29.0	45.2	35.0	8.5	44.5
Consolidation of Indices	C3Pi	Peru	Estonia	67.4	49.1	60.1	60.6	4.1	61.0
	ENVi	Tanzania	Belgium	61.6	31.0	45.1	36.8	7.3	45.2
	SOCi	Norway	Tanzania	87.0	38.1	61.9	39.6	13.3	57.9
	ECOi	Switzerland	Ghana	84.3	41.3	61.1	53.5	9.8	60.6
	TBLi	Switzerland	South Africa	70.1	42.7	54.9	42.7	5.7	53.8
	SDCi	Switzerland	Pakistan	71.2	31.9	50.9	34.2	8.1	50.7
	GCSDi	Switzerland	South Africa	70.7	38.2	52.8	38.2	6.8	52.8

5.5 RESEARCH QUESTION 5

The sub-problem is: Appraise the single integrated SDI to ascertain the extent to which nation state global indices correlate with one another in order to determine what a comparison may reveal. Its corresponding research question is: How well do the indices correlate? The data analysis of this question is contained in section 4.5.

Given, that a coefficient of determination is a quantitative measure that provides a regression line to predict the linear relationship, scatter diagrams were prepared to summarise the findings in terms of the TBLi and its three dimensions, the TBLi compared to the four composite SDIs, and then finally the TBLi in terms of the SDCi and GCSDi. This revealed the following summarised findings, illustrated in Figure 30.

The top four scatter graphs take the three TBL dimensions, ENVi, SOCi, ECOi, as well as the C3Pi, and correlate them to the TBLi:

- Environment/Planet (ENVi:TBLi) – R^2 equals 0.0092, poor.
- Social/People (SOCi:TBLi) – R^2 equals 0.7216, good.

- Economic/Prosperity (ECOi:TBLi) – R^2 equals 0.7523, good.
- Combined 3 Primary Index (C3Pi:TBLi) – R^2 equals 0.0275, very poor.
- This finds that the two socio-economic TBL dimensions show good correlations but the ENVi is poor.

The middle four scatter diagrams correlate the Sustainable Development Composite indices, the LPrI, HPI, SSI, and WI with the TBLi:

- Legatum Prosperity Index (LPrI:TBLi) – R^2 equals 0.6165, good.
- Happy Planet Index (HPI:TBLi) – R^2 equals 0.0009, very poor.
- Sustainable Society Index (SSI:TBLi) – R^2 equals 0.5396, moderate.
- Wellbeing Index (WI:TBLi) – R^2 equals 0.7703, good.
- Given that the LPrI is not well balanced in terms of the TBL, refer research question 2, this specifically seeks the correlation of the other three composite indices. It finds that the WI is the best correlated. The composition of the HPI is heavily based on the EF and confirms a similar poor result as the ENVi above. Another finding is that the only composite SDI index that is published on a regular and up to date basis, the SSI, reveals a moderate result.

The bottom two scatter diagrams bring the findings into focus by illustrating how the TBLi correlates with both the SDCi and the final GCSDi:

- Triple Bottom Line with Sustainable Development Composite (TBLi:SDCi) – R^2 equals 0.7991, good.
- Triple Bottom Line with Global Composite Sustainable Development Index (TBLi:GCSDi) – R^2 equals 0.9208, very good.
- This finds that the two single integrated indices, the TBLi and the GCSDi, are well correlated.

Whilst not illustrated it is worth noting that for the Sustainable Development Composite with the Global Composite Sustainable Development Index (SDCi:GCSDi) the R^2 equals 0.9680, which is also very good.

Essentially, the overall finding reveals that the two single integrated indices, the TBLi and the GCSDi, are well correlated and can be used to represent the twenty constituent (foundational) indices.



Figure 30: Sustainability indexes – Coefficient of Determination

5.6 RESEARCH QUESTION 6

The sub-problem is: Its corresponding research question is: What is South Africa's response to measure sustainability, and how well does it perform? The data analysis of this question is contained in section 4.6. The finding is broadened to integrate the results of research question 3 (section 4.3).

The review of the South African sustainability understanding and the relevant response found that besides many high level endeavours, the state of the environment is poor. The analysis phase found that South Africa delivers the poorest performance of the 79 countries that constitute the GCSDi. The context of South Africa's nation state performance is aptly summarised in a world map (iMapBuilder, 2013), where together with Tanzania and Pakistan they are the three countries below 40% (red).

Whilst the illustrations, Tables 14 and 15 and Figures 28, 29 – also Figures 32 and 33 – chapter 6 are to a large degree self-explanatory, they do infer that South Africa is a very poor performer. When one compares this to the SOER results in Table 5 and 12 and Figure 25 one observes parallel poor performance. The South African understanding appears to be good when reviewing the NFSD (DEAT, 2008), which then flows into the NSSD1 (DEA, 2011), which in turn refers to the NDP, as well as the manner in which the SOER is addressed in the technical report (DEA, 2010), refer Table 6. Curiously, this clear understanding is not systematically linked to, or referred to, in the NDP (NPC, 2012), where the "our future – make it work" report is primarily about delivery on socio-economic issues. Whilst the NDP states a low carbon economy vision by 2030, the plan focuses on socio-economic imperatives, and lacks clarity regarding the "how to achieve" sustainability and specifically environmental sustainability. In essence, although the talk is for a Green Economy, if the focus remains socio-economic one can reasonably predict that by the year 2030 the nested-egg, Figure 33 (chapter 6), will have light green Social (currently red) and Economic (currently amber) dimensions, but will most likely have a remaining red Environmental dimension.

From a South African perspective the context of Figure 33 (chapter 6) needs to be seen alongside the National Development Plan and its focus on socio-economic issues (NPC, 2012). Chapter 5 deals with environmental sustainability and has a 2030 vision which sees South Africa's transition towards a low carbon economy well underway, one with a just society that is environmentally sustainable and climate-change resilient. The NDP has the same 2030 target date to that of the LPI to reach two Planet Earth's, and the critical question is whether the growth driven plan is merely a Business as Usual approach that will contribute towards the increasing overall number of Planet Earth's.

CHAPTER 6: CONCLUSION AND RECOMMENDATIONS

The purpose of this chapter is to demonstrate that the overall aim of the research has been successfully addressed. The chapter provides conclusions and recommendations in terms of the overall aim described in chapter 1 and set out in Table 1.

The concept of sustainability is 40 years old and calls to measure sustainable development began in earnest in 1992. Although there is substantial evidence in the literature calling for a move away from measuring success via economic indicators like the GDP, and towards SDIs, over this 20 year period no single method to measure the sustainability of countries has been accepted worldwide and adopted accordingly.

6.1 SYNTHESIS OF INDICES

Central to the five primary questions was to determine the development of a single integrated SDI. Whilst the findings provide the detailed analysis on how this outcome was achieved it is essential to conclude this argument by providing a diagram that summarises the process.

The pyramid concept used by Eurostat (2007) and depicted in Figure 12, has been used to demonstrate the manner in which the twenty indices have been synthesised into the three integrated SDI's – SDCi, TBLi and GCSDi. Illustrating a number of levels that flow upwards from the contextual indicators in the bottom layer, up to the lead objectives at the top, Figure 31 is made up of four levels, and shows a pyramid within a pyramid in the build up to the final SDI, the GCSDi:

- Indicators – The base of the pyramid is comprised of the twenty contextual indices, where the sixteen individual indicators reside in the inner-left pyramid leading up to the TBLi, and the four composite SD indicators lead into the SDCi;
- Dimensions – This layer consists of the three TBL dimensions that feed into the TBLi. The relative weightings of the indicators as they feed up the pyramid are shown, effectively comprising equal weights within their category, bearing in mind that they were calculated on the geometric mean basis;
- Sub SD Index – Shows the two single integrated sub-SDI's, the TBLi and the SDCi;
- SDI – The top layer indicates the final single integrated SDI, the GCSDi in the main pyramid.

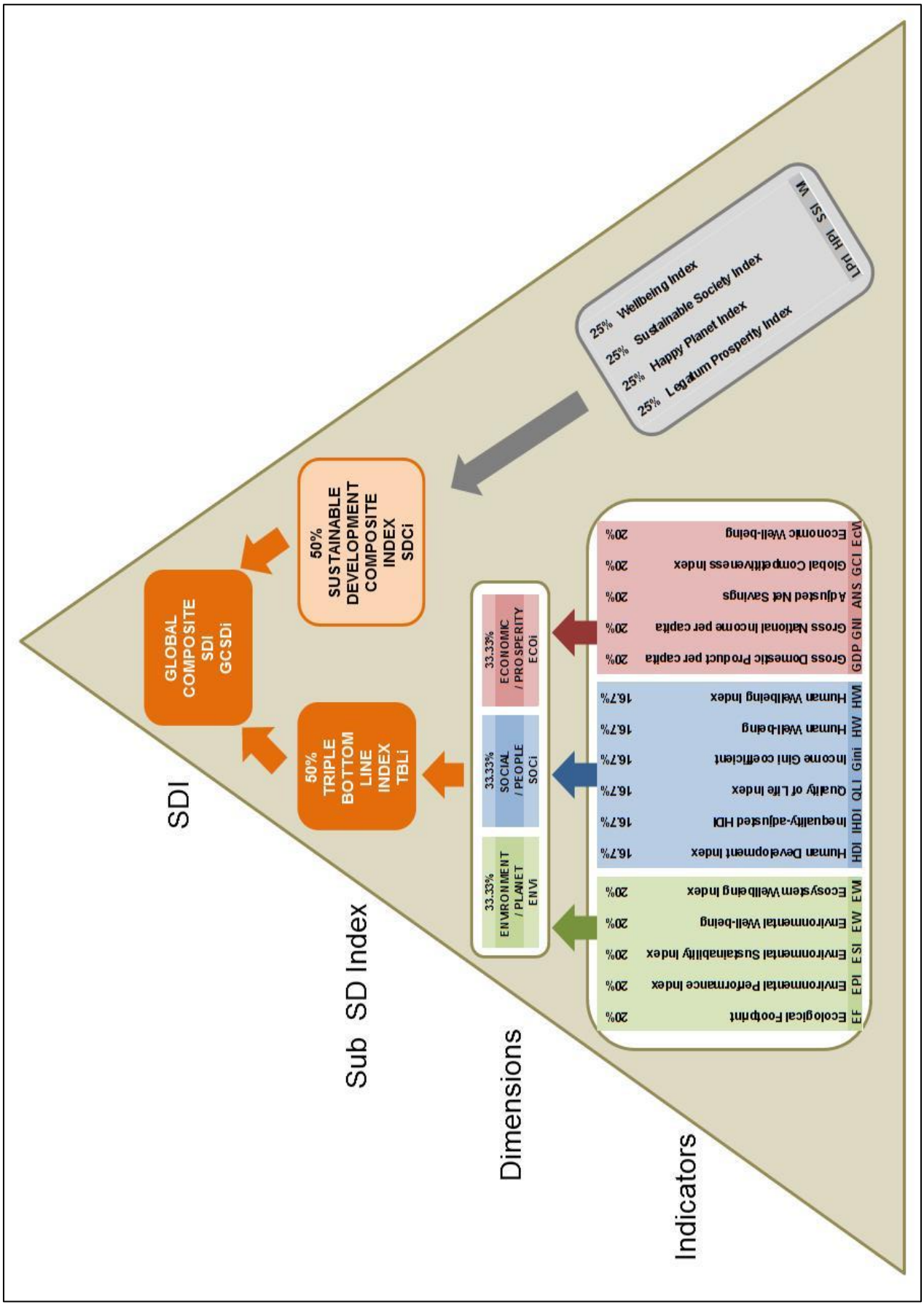


Figure 31: Synthesis of Indices – SDI Pyramid

6.2 VARIATION AND CORRELATIONS

Table 1 described the structure on the study. The first step was to establish a single integrated index, once this had been achieved it was deemed important to appraise this SDI to determine how well it varied and correlated with the indices that formed part of its constituent parts. This found that on a country level there is substantial variation between the indices, reflected in the summarised Table 15 and observational Table 22 (Appendix V). This variation indicates that it is difficult to identify any one of these constituent indices as being a marker for sustainability. The next step was to see if a correlation analysis revealed a more informed picture of the single integrated SDI. Having distilled the detailed correlations in Table 11 the two single integrated SDI's, the TBLi and the GCSDI, both correlate well with the constituent indices, refer Figure 30.

6.3 SUMMARY OF FINDINGS

The main findings from the development of the single integrated SDI are illustrated by summarising the analysis into spider/radar charts. Figure 32 illustrates snapshots that compare South Africa (red) to the top ranked country Switzerland (green), the World mean score (yellow), and the five BRICS countries (blue), for all GCSDi countries (n=79). It was not expected that South Africa would be the bottom ranked country, in which case this country would have been in red. Figure 32 illustrates South Africa's benchmarked performance based on the twenty indices. Figure 35 (Appendix VII) provides the detail of the results from a number of different perspectives.

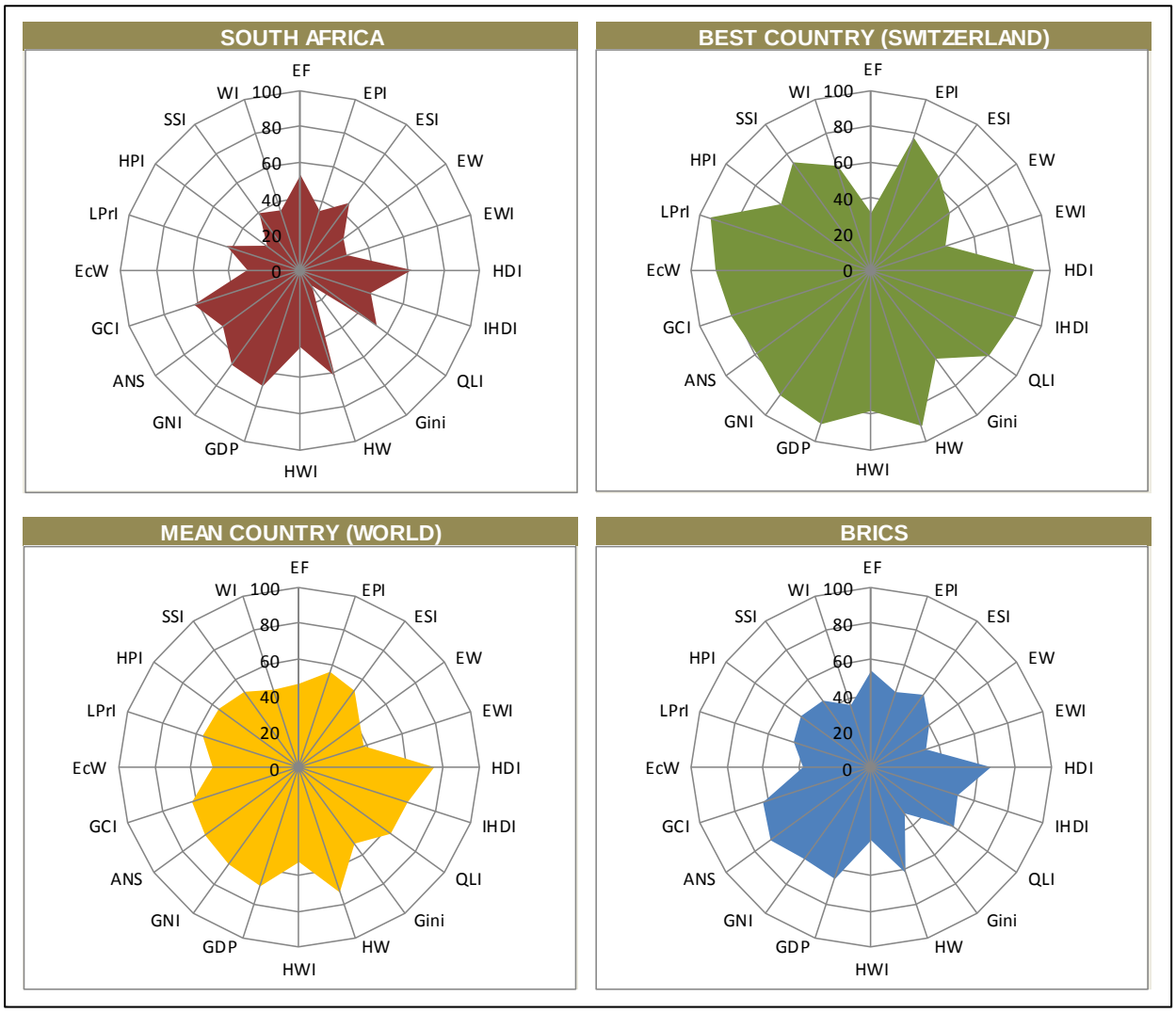


Figure 32: South Africa's benchmarked performance – Twenty indices

Given the systems approach to sustainability the NFSD (DEAT, 2008) framework provides, the final results in Table 14 are condensed into the nested egg framework in Figure 33. The diagram uses a range of five thresholds in colours to display the results of the TBLi. An ideal nested egg, all dark green, is shown in the bottom right corner. The three TBL dimensions make up the nested egg with the overall result displayed in the governance foundation. South Africa is compared to the top country, Switzerland, and the World mean of the 79 countries in the top layer. In the bottom layer South Africa is compared to the five demographic categories that it falls into, again emphasising that South Africa cannot be regarded as a leader in terms of sustainability performance. In all four demographical comparisons South Africa is out performed. Looking at the TBL dimensions, only the Economic dimension out performs two of the demographic categories - in the Africa region (53.5 versus 50.8), and the Medium HDI category (53.5 versus 52.8). The remaining fourteen comparison scores are below the demographic benchmarks.

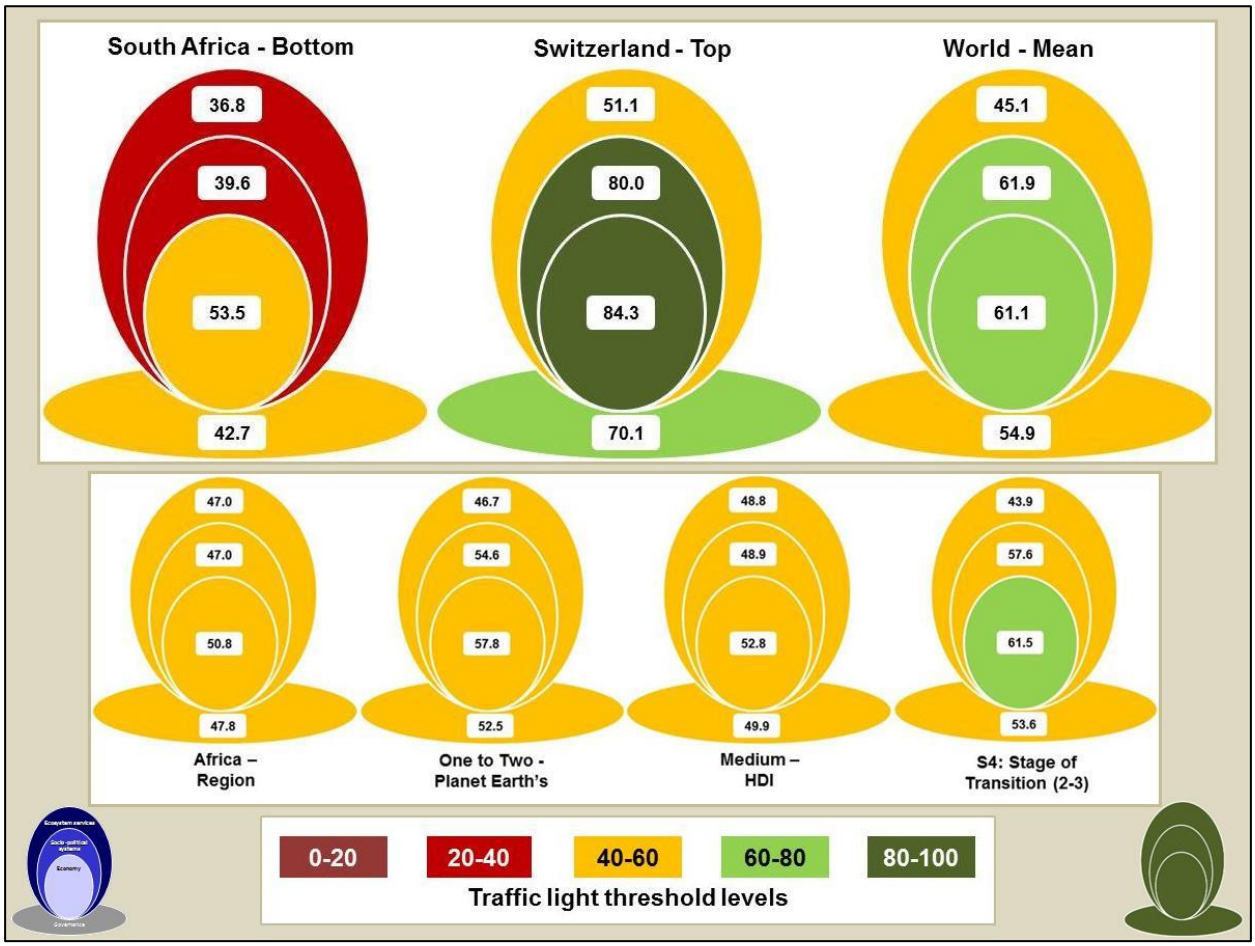


Figure 33: Triple Bottom Line Index - Nested Egg

6.4 GDP VERSUS GLOBAL COMPOSITE SDI

The reliance of using the GDP as a measure of success has been highlighted throughout the study. However, Steffen *et al.* (2004) demonstrated in Figure 3 the effect human activity is having on Earth systems, this cause and effect relationship needs to be integrated into nation state benchmarking to guide policy makers to take the required remedial action. Authors like Stiglitz *et al*. (2010) are leading voices that question the role of GDP in leading policy makers to effectively mis-measure our lives. With this in mind it is appropriate to show in this conclusion the comparative findings of the GDP versus the GCSDi in Figure 34. This reveals an interesting outcome. The three narrowest scatter countries are Nicaragua, Tajikistan and Sri Lanka; whereas the three countries with the widest dispersion are South Africa, and the two cold war countries, the United States of America and Russia. That is two G8 and two BRICS countries on the one end of the continuum (weaker correlation); contrasted with the three countries at the other end (stronger correlation) who are, in terms of HDI category medium developed, with an EF of half to one planet Earth. This finding is consistent with Moran *et al*. (2008).

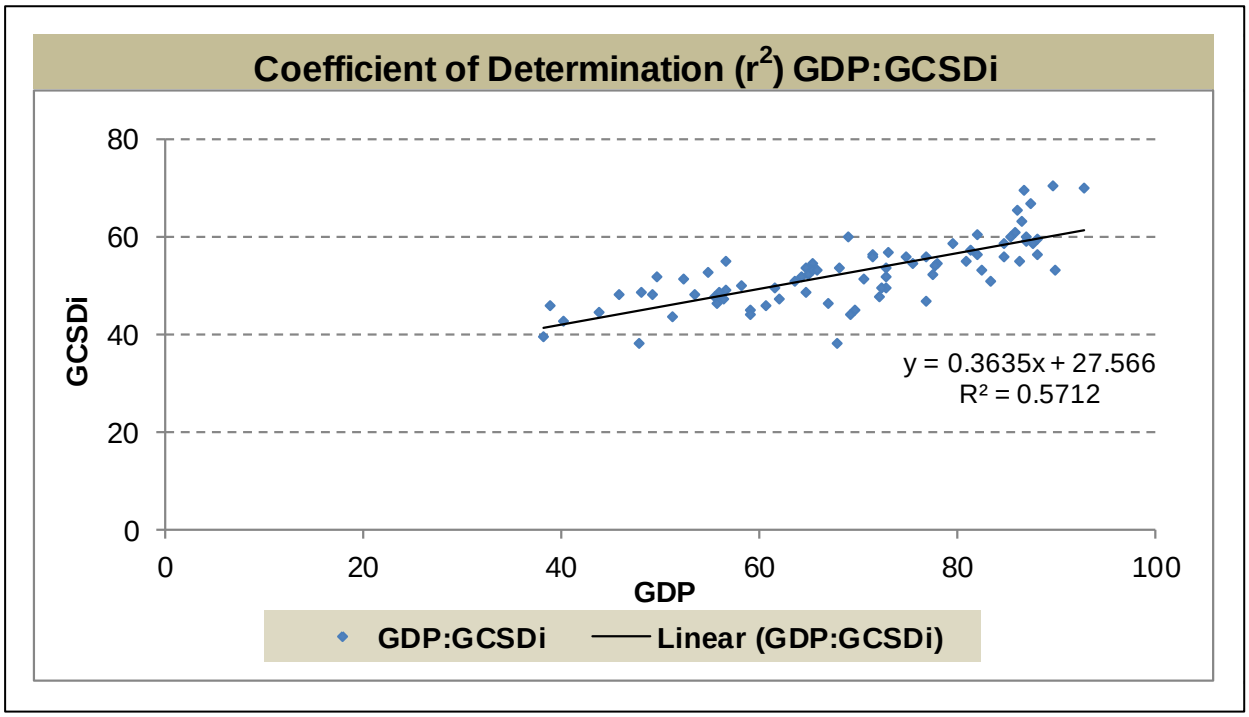


Figure 34: GDP versus GCSDi

6.5 RELEVANCE AND VALUE OF RESEARCH

This analysis has cut across all the relevant data with the intention of developing a single integrated SDI. In essence the relevance of the study is that it has provided an interpretation of nation state sustainability, and the value of study lies in the two condensed benchmark SDI's, the TBLi and the GCSDi. These two benchmark proxy SDIs cover all the TBL dimensional aspects, or sustainability elements. Figure 24 provides the coefficients for determination for these two proxy indices and substantiates their correlation. Either of the two can be used as a single integrated index, dependent upon whether or not to include the four composite SD indices.

6.6 RECOMMENDATIONS FOR FURTHER RESEARCH

The path that measuring Sustainable Development is taking, with the concentrated focus on Human Well-Being and without consideration of limits to growth and thresholds being breached, needs to be challenged. These need to form a fundamental component of SDI development, which will then need strong leadership and policy implementation to change the way GDP dominates the way the world is managed. Essentially, research into thresholds being foundational to SDI development is required.

With this in mind it was felt that this research is incomplete without deriving a different method to evaluate the three dimensions in terms of both priority levels and thresholds. Various different research opportunities exist in this regard. The Sustainability Intelligence Quotient (Si_Q) is proposed to challenge and refocus attention towards the Environment dimension, as illustrated by the nested-egg . The purpose of this model would be to engage a different conversation and start a new dialogue around what SDI measurement aspects are important to the future success of the Planet. The Si_Q confronts the inconvenient truths, and initiates the tough conversation that SDI research and development must consider. The Si_Q methodology uses the results computed in the GCSDi. The final comment on the results that this Si_Q model produces is that the "Business as Usual" approach to measuring what matters has to change. In the words of Senge (2006:111) we need a fundamental solution to solve the underlying problem.

Table 17: Sustainability Intelligence Quotient

Si_Q based on three TBL indices (ENVi, SOCi, ECOi)

Rank	Country	Si_Q	Region	Planet Earth's	HDI Category	Stages of Development	GCSDi Rank
1	***Sri Lanka***	1.072	Asia	***Half to one***	Medium	S3: Efficiency-driven	27
2	Albania	1.011	Europe	One to two	High	S3: Efficiency-driven	37
3	***Indonesia***	1.010	Asia	***Half to one***	Medium	S3: Efficiency-driven	40
4	Ecuador	1.006	Latin America	One to two	High	S3: Efficiency-driven	33
5	Viet Nam	0.993	Asia	Half to one	Medium	S2: Transition stage 1-2	44
6	Peru	0.975	Latin America	Half to one	High	S3: Efficiency-driven	29
7	Dominican Repu	0.974	Latin America	Half to one	Medium	S3: Efficiency-driven	42
8	Costa Rica	0.949	Latin America	One to two	High	S4: Transition stage 2-3	9
9	Brazil	0.928	Latin America	One to two	High	S4: Transition stage 2-3	34
10	Armenia	0.904	Asia	Half to one	High	S3: Efficiency-driven	50
11	Switzerland	0.622	Europe	Two to four	Very High	S5: Innovation-driven	1

In conclusion, the following quotation taken from the final paragraph of the back cover of "Our Common Future" (Brundtland, 1987) twenty-six years ago, challenges those involved with the future development of SDI's with a clear mandate for further research:

"Our Common Future serves notice that the time has come for a marriage of economy and ecology, so that governments and their people can take responsibility not just for environmental damage, but for the policies that cause the damage. Some of these policies threaten the survival of the human race. They can be changed. But we must act now", Brundtland (1987).

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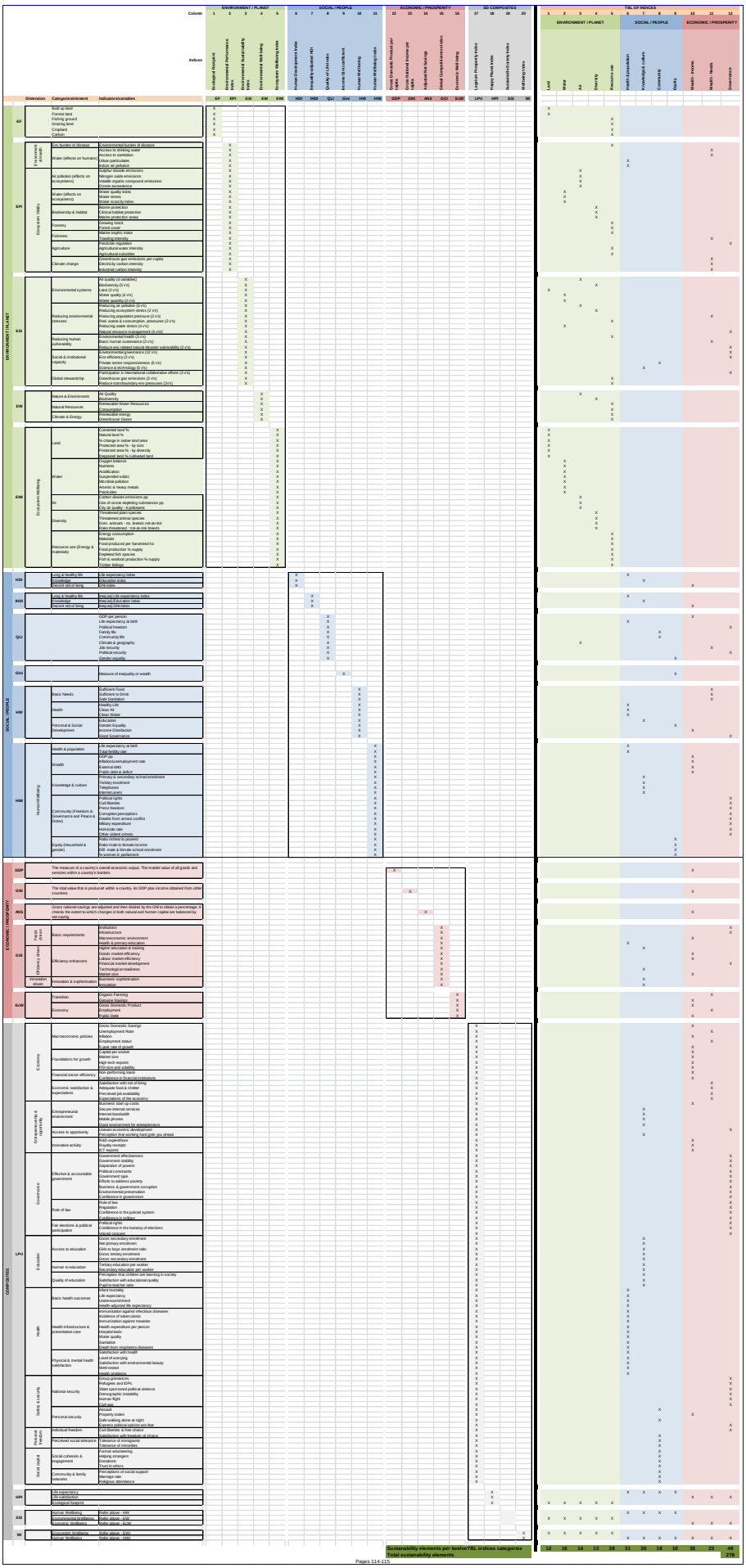
Appendix I: Universe Indices – Published Country Data

Table 18: Universe Indices – Published Country Data

		ENVIRONMENT / PLANET					SOCIAL / PEOPLE							ECONOMIC / PROSPERITY						COMPOSITES				
Column		1	2	3	4	5	6	7	8	9	10	11		12	13	14	15	16		17	18	19	20	
Indices		Ecological Footprint	Environmental Performance Index	Environmental Sustainability Index	Environmental Well-being	Ecosystem Wellbeing Index	Human Development Index	Inequality-Adjusted HDI	Quality of Life Index	Income Gini coefficient	Well-being	Human Wellbeing Index		Gross Domestic Product per capita	Gross National Income per capita	Adjusted Net Savings	Global Competitiveness Index	Economic Well-being		Legatum Prosperity Index	Happy Planet Index	Sustainable Society Index	Wellbeing Index	
Unit of measure/Scale		(hectares per capita)	(0-100)	(0-100)	(0-10)	(0-100)	(0-1)	(0-1)	(0-10)	(0-100)	(0-10)	(0-100)		(PPP $)	(constant 2005 PPP $)	(% of GNI)	(1-7)	(0-10)		(4–4)	(0-100)	(0-10)	(0-100)	
Country	Region	Planet Earth's	HDI Category	Stages of Development	EF	EPI	ESI	EW	EWI	HDI	IHDI	QLI	Gini	HW	HWI	GDP	GNI	ANS	GCI	EcWI	LPxI	HPI	SSI	WI
1 Afganistan	Asia	Less than half	Low	S1: Factor-driven	0.62				48.0	0.398					6.0	1 321	1 416				-3.226	36.8		27.0
2 Albania	Europe	One to two	High	S3: Efficiency-driven	1.91	65.85	58.8	6.14	46.0	0.739	0.637	5.634	34.5	7.97	39.0	8 716	7 803	8.2	3.91	3.22	-0.776	54.1	5.76	42.0
3 Algeria	Africa	Half to one	Medium	S3: Efficiency-driven	1.59	48.56	46.0	4.03	44.0	0.698		5.571	35.3	7.23	29.0	8 172	7 658		3.72	4.04	-1.046	52.2	5.02	36.5
4 Andora	Europe	Not included	Very High	Not given						0.838						26 095								
5 Angola	Africa	Half to one	Low	S3: Efficiency-driven	1.00	47.57	42.9	7.44	67.0	0.486	0.242			4.48	8.0	5 812	4 874	-29.2		1.78	-2.444	33.2	4.30	37.5
6 Antigua and Babuda	Latin America and Caribbean	Not included	High	S5: Innovation-driven					40.0	0.764					49.0	18 778	15 521		0.67					44.5
7 Argentina	Latin America and Caribbean	One to two	Very High	S4: Transition stage 2-3	2.60	58.48	62.7	3.83	40.0	0.797	0.641	6.469	45.8	7.23	55.0	14 538	14 527	10.6	3.07	6.58	0.676	54.1	5.57	47.5
8 Armenia	Asia	Half to one	High	S3: Efficiency-driven	1.75	47.48	53.2	4.10	55.0	0.716	0.639	5.422	30.9	6.79	45.0	5 279	5 188	9.6	4.02	3.14	-1.021	46.0	4.83	50.0
9 Australia	Oceania	Two to four	Very High	S5: Innovation-driven	6.84	56.61	61.0	7.00	28.0	0.929	0.856	7.925	30.5	8.38	79.0	39 539	34 431	1.7	5.12	7.30	3.158	42.0	4.73	53.5
10 Austria	Europe	Two to four	Very High	S5: Innovation-driven	5.30	68.92	62.7	4.47	42.0	0.885	0.820	7.268	26.0	9.21	80.0	38 818	35 719	15.0	5.22	7.04	2.561	47.1	6.56	61.0
11 Azerbaijan	Asia	One to two	High	S4: Transition stage 2-3	1.67	43.11	45.4	3.83	28.0	0.700	0.620	5.377	33.7	6.45	42.0	9 638	8 666	5.4	4.41	4.30	-0.623	40.9	4.79	35.0
12 Bahamas, The	Latin America and Caribbean	Not included	High	Not given					32.0	0.771	0.658				54.0		23 029							43.0
13 Bahrain	Asia	Not included	Very High	Not given					17.0	0.806		6.035			46.0		28 169	10.6	4.63		26.6			31.5
14 Bangladesh	Asia	Less than half	Low	S1: Factor-driven	0.62	42.55	44.1	4.92	46.0	0.500	0.363	5.646	33.2	5.42	27.0	1 416	1 529	27.1	3.65	3.50	-1.185	56.3	4.68	36.5
15 Barbados	Latin America and Caribbean	Not included	Very High	Not given					32.0	0.793		6.702			62.0		17 966		4.42					47.0
16 Belarus	Europe	Half to one	High	S4: Transition stage 2-3	3.80	53.88	52.8	3.32	50.0	0.756	0.693	4.978	27.2	7.53	46.0	13 040	13 439	16.9		4.75	0.096	37.4	4.94	48.0
17 Belgium	Europe	Over four	Very High	S5: Innovation-driven	8.00	63.02	44.4	2.48	23.0	0.886	0.819	7.095	28.0	8.85	80.0	36 313	33 357	13.2	5.21	5.09	2.285	37.1	4.79	51.5
18 Belice	Latin America and Caribbean	Not included	High	S3: Efficiency-driven					64.0	0.699	0.496				50.0	6 628	5 812	9.2			-0.145	59.3		57.0
19 Benin	Africa	Half to one	Low	S1: Factor-driven	1.23	50.38	47.5	7.90	71.0	0.427	0.274		36.5	4.64	27.0	1 508	1 364	4.1	3.61	3.58	-1.776	31.1	5.31	49.0
20 Bhutan	Asia	Not included	Medium	S3: Efficiency-driven			53.5		53.0	0.522				5.58	14.0	5 133	5 263	-14.1		3.12				40.5
21 Bolivia	Latin America and Caribbean	One to two	Medium	S3: Efficiency-driven	2.57	54.57	59.5	5.56	63.0	0.663	0.437	5.492	58.2	5.26	34.0	4 419	4 054	6.2	3.78	3.89	-0.826	43.6	4.98	48.5
22 Bosnia and Herzegovina	Europe	One to two	High	S3: Efficiency-driven	2.75	38.76	51.0	2.59	45.0	0.733	0.649	5.218	36.2	7.57	24.0	8 578	7 664		3.93	2.72	-1.045	42.4	3.92	34.5
23 Botswana	Africa	One to two	Medium	S4: Transition stage 2-3	2.88	53.74	55.9	4.67	68.0	0.633		4.810	63.0	5.39	34.0	13 384	13 043	9.6	4.06	4.53	-0.255	22.6	4.89	51.0
24 Brazil	Latin America and Caribbean	One to two	High	S4: Transition stage 2-3	2.91	60.90	62.2	5.55	36.0	0.718	0.519	6.470	51.9	6.59	45.0	10 367	10 162	4.6	4.40	4.05	0.489	52.9	5.47	40.5
25 Brunei Darussalam	Asia	Not included	Very High	Not given					42.0	0.838					47.0		45 753	-1.8		4.67				43.5
26 Bulgaria	Europe	Two to four	High	S4: Transition stage 2-3	4.07	56.28	50.0	3.41	31.0	0.771	0.683	6.162	45.3	8.14	58.0	13 870	11 412	6.1	4.27	4.74	0.254	34.1	5.13	44.5
27 Burkina Faso	Africa	Half to one	Low	S1: Factor-driven	1.32		45.7	7.52	58.0	0.331	0.215		39.5	4.64	17.0	1 187	1 141	2.3	3.34	3.31	-1.559	31.8	5.11	37.5
28 Burundi	Africa	One to two	Low	S1: Factor-driven	0.90		40.0	6.41	60.0	0.316		4.242	42.4	4.92	6.0	392	368	-6.8	2.78	1.43	-2.954	30.5	3.99	33.0
29 Cambodia	Asia	Medium	Low	S1: Factor-driven	1.03	55.29	53.1	3.24	57.0	0.523	0.380		44.4	5.38	20.0	1 915	1 848	13.0	4.01	3.67	-1.406	40.3	5.74	38.5
30 Cameroon	Africa	Half to one	Low	S2: Transition stage 1-2	1.04	42.97	52.5	6.97	64.0	0.482	0.321		44.6	5.25	15.0	2 205	2 031	6.8	3.69	3.65	-1.668	33.7	5.33	39.5
31 Canada	Northern America	Two to four	Very High	S5: Innovation-driven	7.01	58.41	64.4	2.21	43.0	0.908	0.829	7.599	32.1	8.93	78.0	37 808	35 166	5.8	5.27	3.92	3.108	43.6	4.31	60.5
32 Cape Verde	Africa	Not included	Medium	S3: Efficiency-driven					47.0	0.568					56.0	6 844	3 402		3.55					47.5
33 Central African Republic	Africa	Half to one	Low	S1: Factor-driven	1.32		58.7	7.80	66.0	0.343	0.204		61.3	3.97	16.0	757	707			2.37	-3.271	25.3	4.49	41.0
34 Chad	Africa	Half to one	Low	S1: Factor-driven	1.73		45.0	6.55	59.0	0.328	0.196			3.79	13.0	1 930	1 105		3.05	1.75	-3.175	24.7	3.84	36.0
35 Chile	Latin America and Caribbean	One to two	High	S5: Innovation-driven	3.24	55.34	53.6	3.35	30.0	0.805	0.652	6.789	52.1	6.97	55.0	14 311	13 329	3.2	4.65	4.26	1.126	53.9	4.68	42.5
36 China	Asia	Half to one	High	S3: Efficiency-driven	2.21	48.24	38.6	4.61	28.0	0.687	0.534	6.083	56.0	5.84	36.0	6 828	7 476	39.7	4.83	4.50	0.078	44.7	4.75	32.0
37 Colombia	Latin America and Caribbean	One to two	High	S3: Efficiency-driven	1.87	62.33	58.9	6.26	42.0	0.710	0.479	6.176	53.8	6.06	43.0	8 959	8 315	5.4	4.18	3.78	-0.245	59.8	5.45	42.5
38 Comoros	Africa	Not included	Low	S1: Factor-driven					44.0	0.433	0.240				20.0	1 183	1 079							32.0
39 Congo	Africa	Half to one	Medium	S3: Efficiency-driven	0.96	47.18	53.8	5.99	72.0	0.533	0.367		44.1	4.31	15.0	4 236	3 066	-44.7		2.01	-3.246	34.5	4.03	43.5
40 Congo, Democratic Republic	Africa	Less than half	Low	S1: Factor-driven	0.75	47.49	44.1	7.91	65.0	0.286	0.172			3.60	7.0	319	280			2.28	-1.854	30.5	4.32	36.0
41 Costa Rica	Latin America and Caribbean	One to two	High	S4: Transition stage 2-3	2.69	69.03	59.6	5.82	41.0	0.744	0.581	6.624	50.3	6.63	56.0	11 106	10 497	15.2	4.34	4.61	1.000	54.0	6.15	49.5
42 Cote d'Ivoire	Africa	Half to one	Low	S1: Factor-driven	1.01	53.55	47.3	8.39	57.0	0.400	0.246		41.5	4.66	20.0	1 701	1 387	7.3	3.36	1.84	-2.318	35.9	4.61	38.5
43 Croatia	Europe	One to two	High	S5: Innovation-driven	3.75	64.16	55.9	3.86	33.0	0.796	0.675	6.301	27.0	8.07	57.0	19 986	15 729	12.3	4.04	5.46	0.221	40.6	5.55	45.0
44 Cuba	Latin America and Caribbean	One to two	High	Not given	1.85	56.48	52.3	3.61	45.0	0.776				7.47	40.0		5 416			3.88		56.2	4.83	42.5
45 Cyprus	Asia	Not included	High	S5: Innovation-driven					38.0	0.840	0.755	7.097	29.0	8.66	67.0	30 848	24 841	0.4	4.32	4.98	1.336	45.5	4.66	52.5
46 Czech Republic	Europe	Two to four	Very High	S5: Innovation-driven	5.73	64.79	46.6	2.81	33.0	0.865	0.821	6.629	31.0	8.70	70.0	25 581	21 405	11.3	4.51	4.98	1.461	39.4	5.57	51.5
47 Denmark	Europe	Over four	Very High	S5: Innovation-driven	8.26	63.61	58.2	2.69	31.0	0.895	0.842	7.796	24.8	8.74	81.0	37 720	34 347	10.7	5.29	7.76	3.174	36.6	5.45	56.0
48 Djibouti	Africa	Not included	Low	S2: Transition stage 1-2					60.0	0.430	0.275				18.0	2 319	2 335				-1.896	37.2		39.0
49 Dominica	Latin America and Caribbean	Not included	High	S3: Efficiency-driven					65.0	0.724					56.0	8 883	7 889							50.0
50 Dominican Republic	Latin America and Caribbean	Half to one	Medium	S3: Efficiency-driven	1.47	52.44	43.7	6.02	65.0	0.702	0.530	5.230	48.4	6.00	56.0	8 433	8 087	0.4	3.77	5.10	-0.654	50.7	5.77	47.5
51 Ecuador	Latin America and Caribbean	One to two	High	S3: Efficiency-driven	1.89	60.55	52.4	5.09	56.0	0.720	0.535	6.232	47.3	6.78	43.0	8 268	7 589	4.4	3.94	4.42	-0.488	52.5	5.47	49.5
52 Egypt	Africa	Half to one	Medium	S3: Efficiency-driven	1.66	51.81	44.0	2.93	43.0	0.644	0.489	5.605	34.4	7.45	39.0	5 673	5 393	3.1	3.73	3.96	-1.328	39.6	4.48	41.0
53 El Salvador	Latin America and Caribbean	One to two	Medium	S3: Efficiency-driven	2.03	52.08	43.8	4.83	46.0	0.674	0.495	6.164	46.9	6.28	36.0	6 629	5 925	3.7	3.80	3.75	-0.760	58.9	5.00	41.0
54 Equatorial Guinea	Africa	Not included	High	S3: Efficiency-driven					62.0	0.537					15.0	31 779	17 608							38.5
55 Eritrea	Africa	Less than half	Low	S1: Factor-driven	0.89		38.9		60.0	0.349					10.0	581	536							35.0
56 Estonia	Europe	Over four	Very High	S5: Innovation-driven	7.88	56.09	58.2	2.25	34.0	0.835	0.769	5.905	31.3	8.28	62.0	19 693	16 799	14.4	4.84	7.48	1.123	34.9	4.98	48.0
57 Ethiopia	Africa	Half to one	Low	S1: Factor-driven	1.10	52.71	37.9	8.44	64.0	0.363	0.247		30.0	4.54	13.0	934	971	8.3	3.55	2.52	-2.703	39.2	4.94	36.5
58 Fiji	Oceania	Not included	Medium	S3: Efficiency-driven					46.0	0.688					50.0	4 526	4 145	3.4						48.0
59 Finland	Europe	Over four	Very High	S5: Innovation-driven	6.16	64.44	75.1	3.43	44.0	0.882	0.833	7.618	26.8	9.40	81.0	37 265	32 438	8.1	5.55	7.53	3.076	42.7	6.09	62.5
60 France	Europe	Two to four	Very High	S5: Innovation-driven	5.01	69.00	55.2	3.54	29.0	0.884	0.804	7.084	32.7	8.97	75.0	33 674	30 462	7.0	5.11	4.68	2.101	46.5	5.38	52.0
61 Gabon	Africa	Half to one	Medium	S4: Transition stage 2-3	1.41	57.91	61.7	6.26	62.0	0.674	0.543		44.4	5.63	28.0	14 419	12 296	1.8	3.82	3.25			5.11	45.0
62 Gambia	Africa	One to two	Low	S1: Factor-driven	3.45		50.0	5.63	62.0	0.420	0.238		50.2	4.64	16.0	1 415	1 282	12.9	3.83	2.33			4.20	39.0
63 Georgia	Asia	One to two	High	S3: Efficiency-driven	1.82	56.84	51.5	5.29	41.0	0.733	0.630	5.365	40.8	6.51	48.0	4 774	4 780	-7.1	4.07	3.06	-0.816	46.0	4.99	44.5
64 Germany	Europe	Two to four	Very High	S5: Innovation-driven	5.08	66.91	56.9	3.36	36.0	0.905	0.842	7.046	27.0	8.97	77.0	36 338	34 854	11.4	5.48	5.80	2.603	47.2	5.56	56.5
65 Ghana	Africa	Half to one	Medium	S1: Factor-driven	1.75	47.50	52.8	7.16	38.0	0.541	0.367	5.174	39.5	5.19	22.0	1 552	1 584	-4.7	3.79	2.93	-0.743	40.3	5.07	30.0
66 Greece	Europe	Two to four	Very High	S5: Innovation-driven	5.39	60.04	50.1	2.84	33.0	0.861	0.756	7.163	33.0	8.47	70.0	29 637	23 747	-7.9	3.86	2.95	0.245	40.5	4.32	51.5
67 Grenada	Latin America and Caribbean	Not included	High	S3: Efficiency-driven					49.0	0.748	0.393				53.0	8 362	6 982							52.0
68 Guatemala	Latin America and Caribbean	Half to one	Medium	S3: Efficiency-driven	1.77	51.88	44.0	7.42	44.0	0.574	0.393	5.321	55.1	5.62	23.0	4 720	4 167	4.0	4.01	3.89	-0.906	56.9	5.69	32.5
69 Guinea	Africa	Half to one	Low	S1: Factor-driven	1.67		48.1	6.55	66.0	0.344	0.211		39.4	4.64	15.0	1 048	863	-4.2	2.90	1.36	-2.414	30.0	3.88	40.5
70 Guinea-Bissau	Africa	One to two	Low	S1: Factor-driven	0.96		48.6	8.40	66.0	0.353	0.207			4.75	13.0	1 071	994			2.62			5.07	38.5
71 Guyana	Latin America and Caribbean	Not included	Medium	S3: Efficiency-driven			62.9	3.73	63.0	0.633	0.492		44.6	5.70	51.0	3 240	3 192	-0.4	3.73	3.09		51.2	4.17	57.0
72 Haiti	Latin America and Caribbean	Less than half	Low	S1: Factor-driven	0.68	41.15	34.8	5.73	43.0	0.454	0.271	4.090	59.2	3.88	19.0	1 151	1 123		2.90	2.53	-3.133	41.3	4.04	31.0
73 Honduras	Latin America and Caribbean	One to two	Medium	S3: Efficiency-driven	1.91	52.54	47.4	6.49	45.0	0.625	0.427	5.250	57.7	5.64	33.0	3 842	3 443	9.5	3.88	4.24	-0.875	56.0	5.53	39.0
74 Hong Kong, China (SAR)	Asia	Not included	Very High	S5: Innovation-driven					28.0	0.898		7.347	53.3		62.0	43 229	44 805		5.41		2.213	37.5		54.5
75 Hungary	Europe	One to two	Very High	S5: Innovation-driven	2.99	57.12	52.0	3.48	33.0	0.816	0.759	6.534	24.7	8.66	65.0	20 312	16 581	4.5	4.30	4.73	0.785	37.4	5.29	49.0
76 Iceland	Europe	Not included	Very High	S5: Innovation-driven		66.28	70.8	3.65	43.0	0.898	0.845	7.911	28.0	9.45	80.0	36 795	29 354	4.1	4.74	2.25	2.564	40.2	4.62	61.5
77 India	Asia	Half to one	Medium	S3: Efficiency-driven	0.91	36.23	45.2	4.75	27.0	0.547	0.392	5.759	36.8	5.12	34.0	3 296	3 466	24.1	4.32	3.03	-1.158	50.9	4.37	29.0
78 Indonesia	Asia	Half to one	Medium	S3: Efficiency-driven	1.21	52.29	48.8	5.35	48.0	0.617	0.504	5.814	36.8	6.43	36.0	4 190	3 716	11.0	4.40	3.96	-0.123	55.5	5.32	42.0
79 Iran, Islamic Republic of	Asia	One to two	High	S3: Efficiency-driven	2.68	42.73	39.8	2.96	32.0	0.707		5.343	44.5	6.84	38.0	11 598	10 164		4.22	3.74	-1.161	41.7	4.30	35.0
80 Iraq	Asia	Half to one	Medium	S3: Efficiency-driven	1.35	25.32	33.6	2.32	31.0	0.573				5.72	19.0	3 548	3 177			1.99	-2.489	49.2	3.13	25.0
81 Ireland	Europe	Two to four	Very High	S5: Innovation-driven	6.29	58.69	59.2	2.18	32.0	0.908	0.843	8.333	33.9	9.01	76.0	40 697	29 322	-1.1	4.91	3.43	2.951	42.4	4.66	54.0
82 Israel	Asia	Two to four	Very High	S5: Innovation-driven	4.82	54.64	50.9	2.01	25.0	0.888	0.779	6.488	39.2	7.95	59.0	27 656	25 849	12.2	5.02	5.04	0.720	55.2	4.23	42.0
83 Italy	Europe	Two to four	Very High	S5: Innovation-driven	4.99	66.90	50.1	3.93	30.0	0.874	0.779	7.810	32.0	8.57	74.0	32 430	26 484	6.1	4.46	5.36	1.131	46.4	5.69	52.0
84 Jamaica	Latin America and Caribbean	One to two	High	S3: Efficiency-driven	1.93	54.36	44.7	4.17	35.0	0.727	0.610	6.022	45.5	6.88	54.0	7 833	6 487	6.9	3.84	2.56	-0.119	58.5	4.41	44.5
85 Japan	Asia	Two to four	Very High	S5: Innovation-driven	4.73	63.36	57.3	3.37	25.0	0.901	7.392	37.6	9.12	80.0	32 418	32 295	12.1	5.40	5.39	2.079	47.5	4.90	52.5
86 Jordan	Asia	One to two	High	S3: Efficiency-driven	2.05	42.16	47.8	2.15	28.0	0.698	0.585	5.675	39.7	7.03	38.0	5 597	5 393	3.0	4.23	2.71	-0.491	50.7	3.55	39.0
87 Kazakstan	Asia	Two to four	High	S4: Transition stage 2-3	4.54	32.94	48.6	2.34	32.0	0.745	0.656	5.082	26.7	7.16	43.0	11 510	10 585	-1.2	4.38	3.66	0.379	34.7	3.98	37.5
88 Kenya	Africa	Half to one	Low	S1: Factor-driven	1.11	49.28	45.3	7.49	51.0	0.509	0.338		42.5	4.87	18.0	1 573	1 492	13.1	3.75	2.48	-1.678	38.0	4.83	34.5
89 Kiribati	Oceania	Not included	Medium	S2: Transition stage 1-2						0.624						2 432	3 140							
90 Korea, Democratic People's	Asia	Not listed	Not given	Not given	1.32		29.2	3.69	45.0					6.03	21.0							4.12	33.0	
91 Korea (South)	Asia	Two to four	Very High	S5: Innovation-driven	4.87	57.20	43.0	2.68	27.0	0.897	0.749	6.877	31.0	8.59	67.0	27 100	28 230	20.0	5.12	5.88	1.539	43.8	5.05	47.0
92 Kuwait	Asia	Two to four	High	Not given	6.32	35.54	38.6	1.22	25.0	0.760		4.792		7.62	50.0		47 936	15.7	4.56	5.24	0.948	27.1	3.49	37.5
93 Kyrgyzstan	Asia	Half to one	Medium	S4: Transition stage 1-2	1.25	46.33	48.4	5.20	42.0	0.615	0.526	4.846	33.4	6.53	38.0	2 283	2 036	9.4	3.44	3.24	-0.745	49.1	5.03	40.0
94 Lao People's Democratic Re	Asia	Half to one	Medium	S2: Transition stage 1-2	1.28		52.4	6.90	63.0	0.524	0.405		36.7	5.99	15.0	2 255	2 242	17.8		3.29	-0.659	49.1	5.44	39.0
95 Latvia	Europe	Two to four	Very High	S4: Transition stage 2-3	5.64	70.37	60.4	5.38	46.0	0.805	0.717	6.008	35.2	7.65	62.0	16 437	14 293	20.4	4.35	6.59	0.264	34.9	6.46	54.0
96 Lebanon	Asia	One to two	High	S4: Transition stage 2-3	2.90	47.35	40.5	2.89	37.0	0.739	0.570			7.23	40.0	13 070	13 076	2.7	3.88	2.73	-0.735	42.9	4.02	38.5
97 Lesotho	Africa	Half to one	Low	S1: Factor-driven	1.07				57.0	0.450	0.288		63.2		24.0	1 468	1 694	24.4	3.19	2.61				40.5
98 Liberia	Africa	Half to one	Low	S1: Factor-driven	1.26		43.4	5.66	65.0	0.329	0.213			4.73	9.0	396	265	-18.3	3.71	2.06	-2.486	35.2	4.11	37.0
99 Libyan Arab Jamahiriya	Africa	One to two	High	S4: Transition stage 2-3	3.05	37.68	42.3	1.87	24.0	0.760		5.849		7.26	38.0	16 502	12 637		3.68	2.69		40.8	3.41	31.0
100 Liechtenstein	Europe	Not included	Very High	Not given						0.905							83 717							
101 Lithuania	Europe	Two to four	Very High	S5: Innovation-driven	4.67	65.50	58.9	3.70	44.0	0.810	0.730	6.033	35.5	8.09	61.0	17 308	16 234	6.0	4.41	4.57	0.623	34.6	5.68	52.5
102 Luxembourg	Europe	Not included	Very High	S5: Innovation-driven		69.20		2.91	24.0	0.897	0.799	8.015	26.0	8.76	77.0	83 820	50 557	7.6	5.09	7.25	2.896	29.0	5.53	50.5
103 Macedonia	Europe	Two to four	High	S4: Transition stage 2-3	5.66	46.96	47.2	3.51	42.0	0.728	0.609	5.337	44.2	6.88	46.0	11 159	8 804	11.6	4.04	5.04	-0.455	28.3	4.94	44.0
104 Madagascar	Africa	One to two	Low	S1: Factor-driven	1.79		52.3	5.61	50.0	0.480	0.332		47.5	4.48	24.0	1 004	924	3.9	3.38	3.33		46.8	4.53	37.0
105 Malawi	Africa	Less than half	Low	S1: Factor-driven	0.73		49.3	7.75	62.0	0.400	0.272		39.0	5.40	22.0	794	753			3.38	-1.246	42.5	5.04	42.0
106 Malaysia	Asia	Not included	High	S3: Efficiency-driven	4.86	62.51	54.0	3.62	33.0	0.761		6.608	46.2	7.08	46.0	14 012	13 685	15.4	5.06	4.52	0.473	40.5	5.07	38.5
107 Maldives	Asia	Not included	Medium	S3: Efficiency-driven					47.0	0.661	0.495				49.0	5 476	5 276	31.4						43.5
108 Mali	Africa	One to two	Low	S1: Factor-driven	1.93	53.57	53.1	5.51	44.0	0.359	0.191		40.1	4.88	21.0	1 185	1 123	13.5	3.43	2.64	-1.224	26.0	4.35	32.5
109 Malta	Europe	Not included	Very High	S5: Innovation-driven		48.51		2.17	14.0	0.832		6.934	26.0	7.67	70.0	24 814	21 460		4.41	3.31	1.775	43.1	3.87	42.0
110 Mauritania	Africa	One to two	Low	S1: Factor-driven	2.61		42.6	4.34	40.0	0.453	0.298		39.0	4.80	17.0	1 929	1 859		3.32	1.66	-1.960	32.3	3.54	28.5
111 Mauritius	Africa	Half to one	High	S3: Efficiency-driven	4.26				44.0	0.728	0.631		39.0		54.0	12 838	12 918	8.0	4.35			36.8		49.0
112 Mexico	Latin America and Caribbean	One to two	High	S4: Transition stage 2-3	3.00	49.11	46.2	4.07	21.0	0.770	0.589	6.766	51.7	6.29	45.0	14 258	13 245	9.1	4.36	5.94	-0.096	52.9	5.27

Appendix II: Integration of Sustainability Elements - Grid

Table 19: Integration of Sustainability Elements - Grid


ENVIRONMENT / PLANET
SOCIAL / PEOPLE
ECONOMIC / PROSPERITY
SD COMPOSITES
TBL OF INDICES
Ecological Footprint
Environmental Performance Index
Environmental Sustainability Index
Environmental Well-being
Ecosystem Wellbeing Index
Human Development Index
Inequality-adjusted HDI
Quality of Life Index
Income Gini coefficient
Human Well-being
Human Well-being Index
Gross Domestic Product per capita
Gross National Income per capita
Adjusted net Savings
Global Competitiveness Index
Economic Well-being
Legatum Prosperity Index
Happy Planet Index
Sustainable Society Index
Well-being Index
Land
Water
Air
Diversity
Resource use
Health & population
Intellectual Culture
Community
Equity
Wealth - Income
Wealth - Wealth
Governance
Dimension
Category/environment
Indicators/variables
EF
Built up land
Forest land
Fishing ground
Grazing land
Cropland
Carbon
EPI
Environment Health
Ecosystem Vitality
SDI
ESI
EW
Ecosystem Wellbeing
HDI
HDI
Long & healthy life
Knowledge
Decent std of living
IHDI
Long & healthy life
Knowledge
Decent std of living
QLI
GINI
HW
HumanWellbeing
HWI
ECONOMIC / PROSPERITY
GDP
GNI
ANS
GSI
Basic requirements
Efficiency enhancers
Innovation & sophistication
ECW
LPI
Economy
Entrepreneurship & opportunity
Governance
Education
Health
Safety & security
Personal freedom
Social capital
HPI
SSI
WI
Pages 114-115
Sustainability elements per twelveTBL indices categories
Total sustainability elements
278

Appendix III: Normalized Scores of Universe Data

Table 20: Normalized Scores of Universe Data

					ENVIRONMENT / PLANET					SOCIAL / PEOPLE						ECONOMIC / PROSPERITY						SD COMPOSITES				RESEARCH INDEXES					
					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
Country	Region	Planet Earth's	HDI Category	Stages of Development	EF	EPI	ESI	EW	EoW	HDI	HDI	QLI	GINI	HIV	IHM	GDP	GNI	ANS	GCI	EoW	LPHI	HPI	SSI	WI	EWHI	SOCI	ECOI	TSLI	SOCI	GCSDI
1 Afganistan	Asia	Less than half	Low	S1: Factor-driven	90.28	FALSE	FALSE	FALSE	48.00	39.80	FALSE	FALSE	FALSE	FALSE	8.00	37.88	37.96	FALSE	FALSE	FALSE	0.67	40.84	FALSE	27.00	65.8	15.5	37.9	33.8	9.0	17.5
2 Albania	Europe	One to two	High	S3: Efficiency-driven	58.40	65.85	64.80	51.00	46.00	73.00	53.70	56.34	34.75	78.70	38.00	65.53	62.40	62.68	68.99	32.20	37.10	69.66	57.60	42.00	57.7	60.1	54.9	57.2	49.5	53.2
3 Algeria	Africa	Half to one	Medium	S3: Efficiency-driven	63.60	48.56	46.00	40.30	44.00	69.80	FALSE	55.71	57.02	72.30	29.00	64.59	62.13	FALSE	53.14	40.40	33.18	64.26	50.20	39.50	47.9	54.1	52.0	44.5	48.1
4 Andora	Europe	Not included	Very High	Not given	FALSE	FALSE	FALSE	FALSE	FALSE	83.95	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	#NUM!	83.8	79.7	#NUM!	#NUM!	#NUM!
5 Angola	Africa	Half to one	Low	S3: Efficiency-driven	76.74	47.57	42.90	39.40	47.00	48.60	24.20	FALSE	FALSE	44.80	8.00	59.59	55.66	18.38	FALSE	17.80	52.36	33.95	43.00	37.50	60.0	25.5	32.3	36.7	28.7	31.4
6 Antigua and Babuda	Latin America and Caribbean	Not included	High	SS: Innovation-driven	FALSE	FALSE	FALSE	FALSE	40.00	76.40	FALSE	FALSE	FALSE	FALSE	49.00	76.79	72.25	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	64.0	61.2	74.5	56.7	44.5	50.2
7 Argentina	Latin America and Caribbean	One to two	Very High	S4: Transition stage 2-3	49.66	56.48	62.70	30.80	40.00	84.50	64.69	64.69	37.31	72.30	55.00	73.04	71.35	65.52	43.66	FALSE	58.67	66.66	55.70	47.50	68.5	60.5	68.2	60.2	57.8	59.0
8 Armenia	Asia	Half to one	High	S3: Efficiency-driven	60.88	47.48	53.20	41.00	55.00	71.60	63.90	54.22	67.09	67.90	45.00	58.18	56.56	64.34	57.43	31.40	33.56	55.79	46.30	50.00	51.1	60.9	52.0	54.5	45.6	49.9
9 Australia	Oceania	Two to three	Very High	SS: Innovation-driven	22.25	58.61	61.00	20.00	20.00	92.90	84.60	89.25	34.70	68.07	79.00	87.75	83.90	74.58	73.14	FALSE	85.88	93.70	47.30	53.50	93.6	81.1	73.6	86.1	53.0	58.7
10 Austria	Europe	Two to four	Very High	SS: Innovation-driven	29.48	68.92	62.70	44.70	42.00	88.50	82.00	72.68	80.15	92.10	80.00	87.44	84.19	70.73	74.57	70.40	86.99	57.37	65.60	61.00	47.4	82.3	77.2	67.0	66.9	66.9
11 Azerbaijan	Asia	Two to three	High	S4: Transition stage 2-3	59.00	43.11	45.40	38.30	28.00	70.00	62.00	53.77	60.52	64.50	42.00	67.01	63.91	59.36	63.00	43.00	38.52	47.92	47.90	35.00	41.5	58.0	58.6	52.1	41.4	46.4
12 Bahamas, The	Latin America and Caribbean	Not included	High	Not given	FALSE	FALSE	FALSE	FALSE	32.00	77.10	65.80	FALSE	FALSE	FALSE	54.00	FALSE	77.90	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	43.0	32.0	64.9	77.9	54.5	43.0	48.4
13 Bahrain	Asia	Not included	Very High	Not given	FALSE	FALSE	FALSE	FALSE	40.00	83.60	FALSE	60.25	FALSE	FALSE	24.00	82.79	80.79	65.52	66.54	FALSE	FALSE	69.10	FALSE	52.50	57.9	60.7	70.5	41.2	49.5	52.0
14 Bangladesh	Asia	Less than half	Low	S1: Factor-driven	90.28	42.55	44.10	46.20	46.00	50.00	36.30	56.46	61.66	54.20	27.00	38.88	36.06	55.67	52.14	35.00	31.11	59.33	46.80	36.50	52.1	45.8	47.3	48.3	43.8	46.0
15 Barbados	Latin America and Caribbean	Not included	Very High	Not given	FALSE	FALSE	FALSE	FALSE	32.00	79.30	FALSE	67.02	FALSE	FALSE	62.00	FALSE	74.35	FALSE	63.14	FALSE	FALSE	FALSE	FALSE	47.00	32.0	69.1	68.5	53.3	47.0	50.1
16 Belarus	Europe	Two to three	High	S4: Transition stage 2-3	38.91	51.68	53.50	39.20	43.00	75.60	59.30	46.19	36.74	75.80	46.00	71.44	70.19	72.99	67.11	45.50	50.22	41.93	49.40	48.00	45.0	68.0	64.6	62.2	58.3	60.7
17 Belgium	Europe	Over four	Very High	SS: Innovation-driven	17.61	63.02	44.40	24.80	23.00	88.60	81.90	70.95	74.54	89.50	80.00	86.46	83.21	68.60	74.43	50.90	82.87	41.39	47.90	51.50	31.0	80.5	71.5	56.3	53.9	55.1
18 Belize	Latin America and Caribbean	One to two	Very High	S3: Efficiency-driven	58.40	59.52	58.60	38.60	34.00	69.90	49.50	FALSE	FALSE	73.70	77.00	61.52	58.18	63.86	FALSE	FALSE	46.63	72.80	FALSE	57.00	64.0	55.7	61.1	60.2	57.8	59.0
19 Benin	Africa	Half to one	Low	S1: Factor-driven	70.87	30.38	47.50	79.00	71.00	42.70	27.40	FALSE	54.49	46.40	27.00	39.80	37.42	57.82	51.57	35.80	22.30	29.57	53.10	49.00	62.5	38.1	43.7	47.0	36.2	41.2
20 Bhutan	Asia	Not included	Medium	S3: Efficiency-driven	FALSE	FALSE	53.50	51.40	67.00	52.20	FALSE	FALSE	FALSE	58.40	14.00	57.71	56.84	FALSE	FALSE	31.20	FALSE	FALSE	47.70	40.50	47.0	52.4	58.5	48.3	44.0	44.6
21 Bolivia	Latin America and Caribbean	One to two	Medium	S3: Efficiency-driven	49.99	54.57	59.50	55.60	63.00	66.30	43.70	54.92	19.19	52.60	34.00	55.57	53.03	60.31	54.00	38.90	36.47	52.20	49.80	48.50	56.4	42.0	51.8	49.7	46.3	48.0
22 Bosnia and Herzegovina	Europe	One to two	High	S3: Efficiency-driven	48.07	36.76	51.00	25.90	45.00	73.30	64.90	52.18	55.11	75.70	24.00	65.30	62.15	FALSE	56.14	27.30	33.20	50.33	39.20	34.50	40.2	54.0	49.9	47.7	38.8	43.0
23 Botswana	Africa	One to two	Medium	S4: Transition stage 2-3	49.80	53.74	55.90	46.70	44.00	63.30	FALSE	48.10	53.10	53.90	34.00	71.82	69.79	64.34	65.37	45.30	44.99	8.10	46.90	51.00	54.1	37.4	61.0	61.3	49.5	53.7
24 Brazil	Latin America and Caribbean	One to two	High	S4: Transition stage 2-3	46.47	60.90	62.20	55.50	36.00	71.80	51.90	64.70	27.85	65.90	45.00	68.08	66.19	58.41	62.86	40.50	56.08	65.15	54.70	40.50	51.2	52.1	58.2	53.7	53.3	53.5
25 Brunei Darussalam	Asia	Not included	Very High	Not given	FALSE	FALSE	FALSE	FALSE	40.00	83.80	FALSE	FALSE	FALSE	FALSE	47.00	FALSE	FALSE	58.03	68.21	59.36	FALSE	FALSE	FALSE	44.50	51.2	82.2	69.2	52.1	41.4	46.4
26 Bulgaria	Europe	Two to four	High	S4: Transition stage 2-3	36.96	56.28	50.00	34.10	31.00	77.10	68.30	61.62	38.14	81.40	58.00	72.35	67.85	60.19	61.00	47.40	52.57	35.74	51.30	44.50	40.6	62.3	61.1	53.7	45.5	49.4
27 Burkino Faso	Africa	Half to one	Low	S1: Factor-driven	68.87	FALSE	45.70	75.20	64.00	33.10	21.50	FALSE	41.51	43.60	17.00	36.29	34.87	56.59	49.77	33.10	25.54	31.06	51.10	37.50	60.9	30.7	40.7	45.1	33.5	38.0
28 Burundi	Africa	Half to one	Low	S1: Factor-driven	79.72	FALSE	40.00	64.10	60.00	31.60	FALSE	FALSE	43.15	49.20	6.00	20.04	18.69	44.91	39.71	14.30	4.74	28.27	39.90	33.00	59.2	25.2	24.9	33.3	20.5	26.1
29 Cambodia	Asia	Half to one	Low	S1: Factor-driven	75.90	50.10	52.30	62.40	54.00	52.30	38.00	52.30	38.68	53.80	30.00	43.35	41.77	58.36	54.06	30.70	27.82	46.93	57.40	38.50	58.2	48.2	44.4	48.3	41.2	44.9
30 Cameroon	Africa	Half to one	Low	S2: Transition stage 1-2	75.62	42.97	52.50	69.70	64.00	48.20	32.10	FALSE	39.32	52.50	15.00	45.37	43.13	61.02	52.71	36.50	23.92	34.95	53.30	39.50	59.7	34.4	47.0	45.9	36.4	40.9
31 Canada	Northern America	Two to four	Very High	SS: Innovation-driven	21.56	58.41	64.40	22.10	43.00	90.80	82.90	78.99	64.30	78.00	87.00	87.66	83.97	59.83	75.29	59.20	95.10	52.20	43.10	60.50	37.8	79.7	66.4	58.5	60.0	59.2
32 Cape Verde	Africa	Not included	High	S3: Efficiency-driven	FALSE	FALSE	FALSE	FALSE	36.00	68.40	FALSE	FALSE	FALSE	FALSE	47.00	52.74	51.23	FALSE	50.71	FALSE	50.52	47.43	55.50	47.00	47.0	51.7	55.3	50.2	47.8	48.9
33 Central African Republic	Africa	Half to one	Low	S1: Factor-driven	68.87	FALSE	58.70	78.00	66.00	34.30	20.40	FALSE	45.26	39.70	16.00	29.69	28.01	FALSE	FALSE	23.70	-	15.75	44.90	41.00	67.5	23.2	27.0	34.9	#NUM!	#NUM!
34 Chad	Africa	Half to one	Low	S1: Factor-driven	64.37	FALSE	58.40	65.50	58.00	39.00	18.60	FALSE	FALSE	37.60	14.00	37.63	36.40	FALSE	FALSE	1.44	14.16	38.40	47.00	37.50	57.1	23.7	29.6	37.1	27.1	31.9
35 Chile	Latin America and Caribbean	One to two	Very High	SS: Innovation-driven	43.42	55.34	53.60	33.50	30.00	80.50	65.20	67.89	27.56	69.70	55.00	72.81	70.07	58.75	66.43	42.60	65.59	66.41	46.80	42.50	41.9	57.9	60.6	52.8	53.5	53.2
36 China	Asia	Two to three	High	S3: Efficiency-driven	54.27	42.24	38.50	38.20	42.00	68.70	53.40	60.83	46.90	58.00	32.00	58.90	61.95	61.73	60.00	51.40	54.47	68.50	53.67	42.50	52.0	58.2	59.0	49.7	45.3	47.6
37 Colombia	Latin America and Caribbean	One to two	High	S3: Efficiency-driven	59.00	62.33	58.90	62.60	42.00	71.00	47.90	61.76	25.13	60.60	43.00	65.94	63.31	59.36	59.71	37.80	45.13	73.37	54.50	42.50	56.4	48.9	56.2	53.7	52.6	53.2
38 Comoros	Africa	Not included	Low	S1: Factor-driven	FALSE	FALSE	FALSE	FALSE	44.00	54.40	46.90	56.05	58.97	74.50	25.00	59.23	56.78	56.64	53.60	FALSE	50.46	45.76	44.80	41.00	45.3	50.1	55.1	51.1	49.5	50.3
39 Congo	Africa	Half to one	Medium	S3: Efficiency-driven	77.89	47.18	52.80	59.90	54.00	53.30	26.70	FALSE	FALSE	53.10	21.00	54.56	49.02	FALSE	FALSE	21.10	0.57	36.52	40.30	43.50	61.1	33.5	#NUM!	#NUM!	12.4	#NUM!
40 Congo, Democratic Republic	Africa	Less than half	Low	S1: Factor-driven	84.89	47.49	44.10	79.10	65.00	28.60	17.20	FALSE	FALSE	36.00	7.00	17.02	14.75	FALSE	FALSE	22.80	21.14	28.27	43.20	36.00	62.0	18.8	17.3	27.5	31.0	29.2
41 Costa Rica	Latin America and Caribbean	One to two	High	S4: Transition stage 2-3	48.70	68.03	59.10	69.20	44.00	76.00	61.30	68.24	30.52	69.30	57.00	69.09	65.65	70.97	68.11	40.10	63.70	77.83	61.50	48.50	60.6	62.2	68.1	66.0	55.4	59.7
42 Cote d'Ivoire	Africa	Half to one	Low	S1: Factor-driven	76.45	53.55	47.30	83.90	57.00	40.00	24.60	FALSE	44.77	46.60	20.00	41.57	37.66	61.61	48.00	18.40	14.22	39.19	46.10	38.50	62.1	33.3	38.6	43.1	31.5	36.8
43 Croatia	Europe	Two to four	High	S4: Transition stage 2-3	39.28	64.18	59.50	38.60	42.00	83.70	67.50	63.01	70.79	77.30	70.00	72.75	72.44	65.50	67.43	55.50	70.52	47.43	55.50	45.00	45.1	70.3	65.4	60.2	62.2	62.2
44 Cuba	Latin America and Caribbean	One to two	High	Not given	59.30	56.48	52.30	36.10	45.00	77.60	FALSE	FALSE	FALSE	74.70	40.00	FALSE	57.17	FALSE	FALSE	38.80	FALSE	69.21	48.30	42.50	49.1	61.4	47.1	52.2	52.2	52.2
45 Cyprus	Asia	Not included	Very High	SS: Innovation-driven	FALSE	57.15	51.50	24.00	36.00	84.30	73.50	70.97	71.89	84.60	57.00	84.07	78.99	53.44	61.84	68.72	55.06	46.60	52.50	47.40	37.4	75.7	64.3	55.2	55.9	55.6
46 Czech Republic	Europe	Two to four	Very High	SS: Innovation-driven	27.27	64.79	46.60	28.10	33.00	86.50	82.10	66.29	66.84	87.00	70.00	81.33	76.86	66.35	64.43	79.80	70.58	45.42	55.70	51.50	37.7	75.9	73.4	59.5	55.1	57.2
47 Denmark	Europe	Over four	Very High	SS: Innovation-driven	18.92	63.61	58.20	20.90	19.00	92.60	84.20	77.58	83.73	87.40	83.00	87.02	83.63	65.64	76.47	66.10	90.44	60.48	54.60	58.00	35.0	83.9	77.5	66.7	69.7	68.2
48 Djibouti	Africa	Not included	Low	S1: Factor-driven	FALSE	FALSE	FALSE	FALSE	60.00	43.00	27.50	FALSE	FALSE	FALSE	18.00	46.51	45.12	FALSE	FALSE	FALSE	20.51	41.57	FALSE	39.00	60.0	27.7	45.6	42.3	32.2	36.9
49 Dominica	Latin America and Caribbean	Not included	High	S3: Efficiency-driven	FALSE	FALSE	FALSE	FALSE	65.00	72.40	FALSE	FALSE	FALSE	FALSE	56.00	65.81	62.56	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	60.50	65.0	63.7	64.2	54.3	60.5	62.4
50 Dominican Republic	Latin America and Caribbean	One to two	High	S3: Efficiency-driven	65.62	52.44	54.70	60.20	43.00	68.30	51.50	58.30	33.14	64.70	49.00	65.05	62.02	53.44	53.86	51.00	39.04	62.61	57.70	47.50	53.0	51.8	57.0	52.2	48.9	50.3
51 Ecuador	Latin America and Caribbean	One to two	High	S3: Efficiency-driven	58.70	60.55	52.40	50.90	56.00	72.00	53.50	62.72	34.88	67.80	43.00	64.76	62.01	58.18	56.29	44.20	41.52	64.64	54.70	49.50	55.6	53.9	56.6	55.4	51.9	53.6
52 Egypt	Africa	Half to one	Medium	S3: Efficiency-driven	62.37	55.18	44.60	51.00	43.00	64.40	46.90	56.05	58.97	74.50	26.00	59.23	56.78	56.64	53.60	31.60	35.26	45.76	44.80	41.00	45.3	50.1	55.1	51.1	49.5	50.3
53 El Salvador	Latin America and Caribbean	Not included	High	S3: Efficiency-driven	56.67	52.08	43.80	48.30	46.00	67.40	49.50	61.64	35.52	62.80	36.00	61.52	58.46	57.35	54.29	37.50	37.45	53.25	50.00	41.00	49.2	50.5	53.0	50.9	48.5	49.7
54 Equatorial Guinea	Africa	Not included	Medium	Not given	FALSE	FALSE	FALSE	FALSE	62.00	53.70	FALSE	FALSE	FALSE	FALSE	24.00	54.53	54.06	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	50.0	53.7	56.2	52.1	50.9	51.5
55 Eritrea	Africa	Less than half	Low	S1: Factor-driven	80.04	38.39	FALSE	FALSE	60.00	34.90	FALSE	FALSE	FALSE	FALSE	10.00	25.81	24.05	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	35.0	56.9	18.7	24.9	29.8	35.0	32.9
56 Estonia	Europe	Over four	Very High	SS: Innovation-driven	18.24	56.09	59.20	22.50	34.00	83.10	74.80	74.12	62.60	82.60	72.00	80.34	77.39	70.02	68.74	74.90	85.57	37.29	49.60	48.00	34.0	71.1	72.3	55.9	59.1	57.5
57 Ethiopia	Africa	Half to one	Low	S1: Factor-driven	74.04	47.18	52.80	59.90	52.00	53.30	26.70	FALSE	FALSE	53.10	21.00	54.56	49.02	FALSE	FALSE	21.10	0.57	36.52	40.30	43.50	61.1	33.5	#NUM!	#NUM!	12.4	#NUM!
58 Fiji	Oceania	Not included	Medium	Not given	FALSE	FALSE	FALSE	FALSE	46.00	68.80	FALSE	FALSE	FALSE	56.00	7.00	17.02	14.75	FALSE	FALSE	22.80	21.14	28.27	43.20	36.00	62.0	18.8	17.3	27.5	31.0	29.2
59 Finland	Europe	Two to four	Very High	SS: Innovation-driven	28.22	64.44	75.10	34.30	44.00	88.20	81.30	76.18	77.88	84.90	81.00	89.03	82.61	62.56	75.30	64.50	90.70	59.50	60.90	62.50	45.0	83.2	76.7	66.0	65.4	65.7
60 France	Europe	Two to four	Very High	SS: Innovation-driven	31.07	69.00	55.20	35.40	29.00	89.40	80.40	70.84	62.80	89.70	75.00	85.36	81.91	61.26	73.00	46.60	80.13	56.52	53.80	52.00	41.4	77.3	68.1	60.2	59.7	59.9
61 Gabon	Africa	Half to one	Medium	S3: Efficiency-driven	67.00	37.91	44.70	62.60	62.00	67.40	54.30	FALSE	FALSE	58.30	28.00	72.92	70.95	55.09	54.57	32.50	FALSE	51.10	45.00	62.2	49.0	54.7	49.1	49.0	51.4	50.2
62 Gambia	Africa	One to two	Low	S1: Factor-driven	41.65	FALSE	50.00	56.30	62.00	42.00	23.80	FALSE	30.37	46.40	16.00	38.87	36.54	68.25	54.71	23.30	FALSE	42.00	39.00	51.9	29.6	41.5	39.9	40.5	40.2
63 Georgia	Asia	One to two	High	S3: Efficiency-driven	59.77	56.64	51.50	52.90	41.00	73.30	63.00	53.65	46.06	65.10	48.00	56.70	55.38	44.55	54.00	30.60	36.62	55.76	49.90	42.50	47.4	47.8	52.2	49.2	42.1	45.1
64 Germany	Europe	Two to four	Very High	SS: Innovation-driven	30.68	66.91	56.90	33.60	36.00	90.50	84.20	70.48	77.30	89.70	77.00	86.47	83.84	66.47	78.29	58.00	87.60	57.52	55.60	56.50	42.7	81.2	73.8	63.5	63.1	63.3
65 Ghana	Africa	Half to one	Medium	S3: Efficiency-driven	60.88	47.50	52.80	71.60	38.00	54.10	36.70	51.74	48.70	51.90	22.00	40.22	39.57	47.39	54.14	29.30	37.71	46.93	50.70	30.00	52.9	42.3	41.3	45.2	40.5	42.8
66 Greece	Europe	Two to four	High	SS: Innovation-driven	29.60	60.04	51.00	28.40	34.00	86.10	75.60	71.83	62.11	84.90	70.00	83.47	79.34	43.62	63.54	54.40	52.44	47.26	43.20	51.50	38.2	74.8	64.1	54.2	51.8	53.0
67 Grenada	Latin America and Caribbean	Not included	High	S3: Efficiency-driven	FALSE	FALSE	FALSE	FALSE	49.00	74.80	FALSE	FALSE	FALSE	FALSE	55.00	64.92	60.81	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	52.00	49.0	64.1	62.8	52.8	52.0	55.0
68 Guatemala	Latin America and Caribbean	One to two	Medium	S3: Efficiency-driven	60.56	51.88	44.00	74.20	44.00	57.40	39.90	53.21	23.33	54.00	29.00	56.54	54.42	38.90	46.23	19.04	36.20	39.04	56.90	33.90	53.8	39.2	52.3	49.0	46.6	47.3
69 Guinea	Africa	Half to one	Low	S1: Factor-driven	62.20	FALSE	48.10	65.50	66.00	34.40	21.10	FALSE	48.70	46.40	15.00	34.46	30.87	47.99	41.43	13.49	12.79	27.16	38.80	40.50	60.0	30.1	31.0	38.3	27.2	32.2
70 Guinea-Bissau	Africa	Half to one	Low	S1: Factor-driven	77.88	FALSE	47.60	42.00	56.00	35.30	20.70	FALSE	47.50	13.00	34.78	32.89	FALSE	FALSE	28.20	FALSE	50.70	39.50	67.7	25.9	31.1	37.0	44.8	40.2	42.5	
71 Guyana	Latin America and Caribbean	Not included	Medium	S3: Efficiency-driven	70.87	FALSE	62.90	37.30	63.00	63.30	49.20	FALSE	39.32	57.00	51.00	51.02	49.60	52.49	53.29	30.90	FALSE	62.97	41.70	57.00	52.9	51.3	46.6	50.2	53.1	51.6
72 Haiti	Latin America and Caribbean	One to two	High	S4: Transition stage 2-3	67.66	41.15	34.80	57.30	43.00	45.40	27.10	FALSE	39.40	39.40	19.00	35.94	34.64	51.35	44.57	32.50	FALSE	40.40	48.57	40.40	49.9	29.5	33.8	36.4	33.3	34.9
73 Honduras	Latin America and Caribbean	One to two	Medium	S3: Efficiency-driven	58.40	52.54	47.40	64.90	45.00	62.50	42.70	52.50	19.84	56.40	33.00	53.52	50.69	64.22	55.43	42.40	35.74	68.97	55.30	39.00	53.2	41.6	52.8	48.9	48.0	48.4
74 Hong Kong, China (SAR)	Asia	Not included	High	SS: Innovation-driven	FALSE	FALSE	FALSE	FALSE	54.00	89.80	FALSE	73.47	25.84	FALSE	72.00	89.02	87.44	FALSE	77.29	FALSE	81.79	42.11	FALSE	FALSE	#NUM!	55.4	84.4	#NUM!	58.7	#NUM!
75 Hungary	Europe	One to two	Very High	SS: Innovation-driven	45.70	57.12	52.00	34.80	33.00	81.60	75.00	65.34	84.03	73.10	65.00	77.94	73.20	58.33	61.43	47.30	60.50	43.62	50.90	49.00	43.5	75.9	71.1	60.2	63.8	62.0
76 Iceland	Europe	Not included	Very High	Not given	FALSE	66.28	70.80	38.50	43.00	89.80	84.50	79.11	74.54	94.50	80.00	86.66	81.38	57.82	67.71	22.50	87.02	46.76	46.20	61.50	52.1	83.5	57.4	63.0	58.3	60.6
77 India	Asia	Half to one	Medium	S3: Efficiency-driven	79.41	36.23	45.20	47.50	27.00	54.70	39.20	57.51	53.87	51.30	31.00	51.27	50.79	51.52	50.37	30.50	31.52	42.57	43.70	29.00	44.1	42.2	52.4	47.3	39.8	43.6
78 Indonesia	Asia	Half to one	Medium	S3: Efficiency-driven	71.33	52.29	48.80	53.50	48.00	61.70	50.40	58.14	53.87	64.30	36.00	54.82	51.78	68.00	62.86	39.60	46.96	68.37	53.20	42.00	53.2	54.2	53.8	51.8	52.8	
79 Iran, Islamic Republic of	Asia	Half to one	Medium	S3: Efficiency-driven	48.80	42.73	39.00	29.60	32.00	70.70	FALSE	53.43	39.49	48.40	34.00	69.67	66.19	61.54	60.29	47.40	31.47	49.22	46.00	34.00	37.9	52.2	62.3	48.3	39.6	43.3
80 Iraq	Asia	Half to one	Medium	S3: Efficiency-driven	68.23	25.32	33.60	23.20	31.00	57.30	FALSE	FALSE	FALSE	57.20	19.00	52.35	49.53	FALSE	FALSE	19.90	11.67	60.30	31.30	25.00	33.4	39.6	37.2	36.7	27.2	31.6
81 Ireland	Europe	Two to four	Very High	SS: Innovation-driven	24.65	58.69	59.20	21.80	31.00	92.60	84.30	84.68	60.08	90.10	76.00	88.14	81.36	51.66	70.71	34.30	92.88	50.33	41.60	54.00	35.9	80.0	61.7	56.2	56.9	56.5
82 Israel	Europe	Two to four	Very High	SS: Innovation-driven	32.17	64.54	50.90	20.10	25.00	88.60	77.90	76.88	49.09	85.50	62.00	82.47	78.56	67.42	71.71	52.40	59.53	68.64	48.80	42.50	33.9	68.5	69.7	57.2	58.4	57.8
83 Italy	Europe	Two to four	Very High	SS: Innovation-driven	31.19	68.90	50.10	39.30	30.00	87.40	77.90	70.10	64.44	85.70	74.00	84.81	79.91	60.19	63.71	53.60	65.66	56.37	56.90	52.00	41.8	77.5	67.4	60.2	57.5	58.9
84 Jamaica

Appendix IV: Combined 3 Primary index

Table 21: Combined 3 Primary index

COUNTRY COMPARISON OF THREE PRIMARY INDICATORS AND ESTABLISHMENT OF COMBINED 3 PRIMARY INDEX

	ECOLOGICAL FOOTPRINT (EF)		HUMAN DEVELOPMENT INDEX (HDI)		GROSS DOMESTIC PRODUCT (GDP)		COMBINED PROXY INDEX (C3Pi)					
							Normalised score				C3Pi	
	Rank	Country (ha pc)	Rank	Country (0 - 1)	Rank	Country (PPP $)	EF	HDI	GDP	Rank Country	Ave	Geomean
Top quadrant	1	Timor-Leste 0.44	1	Norway 0.94	1	Qatar 91 379	67.0	67.4	72.9	1 Gabon	69.1	69.05
	2	Afganistan 0.62	2	Australia 0.93	2	United Arab Emirates 57 744	64.5	72.5	65.4	2 Peru	67.5	67.37
	3	Bangladesh 0.62	3	Netherlands 0.91	3	Norway 56 214	65.8	68.9	65.0	3 Dominican Republic	66.6	66.57
	4	Haita 0.68	4	United States of America 0.91	4	Singapore 50 633	45.7	81.6	77.9	4 Hungary	68.4	66.24
	5	Malawi 0.73	5	Canada 0.91	5	United States of America 45 989	49.7	79.7	73.0	5 Argentina	67.5	66.12
	6	Congo, Democratic Republic 0.75	6	Ireland 0.91	6	Switzerland 45 224	63.6	69.8	64.6	6 Algeria	66.0	65.94
	7	Mozambique 0.77	7	New Zealand 0.91	7	Ireland 40 697	58.4	73.9	65.5	7 Albania	65.9	65.64
	8	Pakistan 0.77	8	Germany 0.91	8	Netherlands 40 676	71.3	69.1	56.7	8 Sri Lanka	65.7	65.38
	9	Eritrea 0.89	9	Sweden 0.90	9	Australia 39 539	52.0	76.6	70.1	9 Serbia	66.2	65.38
	10	Burundi 0.90	10	Switzerland 0.90	10	Austria 38 818	59.0	70.0	67.0	10 Azerbaijan	65.3	65.17
	11	India 0.91	11	Japan 0.90	11	Canada 37 808	44.8	76.0	81.3	11 Trinidad and Tobago	67.4	65.16
	12	Zambia 0.91	12	Korea (South) 0.90	12	Denmark 37 720	59.0	71.0	65.9	12 Colombia	65.3	65.12
	13	Yemen 0.94	13	Denmark 0.90	13	Sweden 37 377	48.5	78.1	72.8	13 Romania	66.5	65.07
	14	Congo 0.96	14	Israel 0.89	14	Germany 36 338	58.7	72.0	64.8	14 Ecuador	65.2	64.93
	15	Guinea-Bissau 0.96	15	Belgium 0.89	15	Belgium 36 313	58.1	72.7	63.6	15 Jamaica	64.8	64.52
	16	Togo 0.97	16	Austria 0.89	16	Finland 35 265	58.5	69.8	64.8	16 Tunisia	64.4	64.21
	17	Angola 1.00	17	France 0.88	17	United Kingdom 35 155	46.9	76.8	71.5	17 Panama	65.0	63.59
	18	Tajikistan 1.00	18	Slovinia 0.88	18	France 33 674	45.1	76.0	74.9	18 Libyan Arab Jamahiriya	65.3	63.57
	19	Cote d'Ivoire 1.01	19	Finland 0.88	19	Italy 32 430	45.6	77.0	72.8	19 Mexico	65.1	63.45
	20	Rwanda 1.02	20	Spain 0.88	20	Japan 32 418	43.4	80.5	72.8	20 Chile	65.6	63.37
	21	Cambodia 1.03	21	Italy 0.87	21	Spain 32 150	60.9	71.6	58.2	21 Armenia	63.6	63.30
	22	Cameroon 1.04	22	Singapore 0.87	22	Greece 29 617	31.0	90.3	89.7	22 Switzerland	70.3	63.10
	23	Sierra Leone 1.05	23	Czech Republic 0.87	23	New Zealand 28 993	48.7	74.4	69.1	23 Costa Rica	64.1	63.02
	24	Lesotho 1.07	24	United Kingdom 0.86	24	Israel 27 656	32.7	90.1	84.8	24 Japan	69.2	62.99
	25	Senegal 1.09	25	Greece 0.86	25	Slovinia 27 133	59.8	73.3	56.7	25 Georgia	63.3	62.86
	26	Ethiopia 1.10	26	United Arab Emirates 0.85	26	Korea (South) 27 100	28.1	94.3	92.9	26 Norway	71.8	62.68
	27	Kenya 1.11	27	Estonia 0.84	27	Czech Republic 25 581	37.0	83.4	79.7	27 Slovakia	66.7	62.67
	28	Tanzania 1.18	28	Slovakia 0.83	28	Trinidad and Tobago 25 572	46.6	73.9	71.5	28 Lebanon	64.0	62.66
	29	Indonesia 1.21	29	Qatar 0.83	29	Portugal 24 920	48.6	69.9	72.1	29 Turkey	63.5	62.57
	30	Sri Lanka 1.21	30	Hungary 0.82	30	Saudi Arabia 23 480	39.3	79.6	77.7	30 Croatia	65.5	62.40
	31	Morocco 1.22	31	Poland 0.81	31	Slovakia 22 882	46.7	73.5	70.6	31 Venezuela	63.6	62.33
	32	Benin 1.23	32	Lithuania 0.81	32	Hungary 20 312	71.3	61.7	54.8	32 Indonesia	62.6	62.26
	33	Kyrgyzstan 1.25	33	Portugal 0.81	33	Croatia 19 986	48.8	70.7	69.7	33 Iran, Islamic Republic of	63.1	62.18
	34	Liberia 1.26	34	Chile 0.81	34	Estonia 19 693	30.7	90.5	86.5	34 Germany	69.2	62.15
	35	Lao People's Democratic Rep 1.28	35	Latvia 0.81	35	Russian Federation 18 932	31.8	90.8	83.2	35 New Zealand	68.6	62.13
	36	Philippines 1.30	36	Argentina 0.80	36	Poland 18 905	62.4	64.4	59.2	36 Egypt	62.0	61.97
Upper-middle quadrant	37	Burkino Faso 1.32	37	Croatia 0.80	37	Lithuania 17 308	31.8	86.3	86.0	37 United Kingdom	68.0	61.77
	38	Central African Republic 1.32	38	Uraguay 0.78	38	Libyan Arab Jamahiriya 16 502	32.2	88.8	82.5	38 Israel	67.8	61.76
	39	Iraq 1.35	39	Romania 0.78	39	Latvia 16 437	56.7	67.4	61.5	39 El Salvador	61.9	61.71
	40	Moldova 1.39	40	Bulgaria 0.77	40	Argentina 14 538	31.9	89.7	82.2	40 Korea (South)	67.9	61.71
	41	Viet Nam 1.40	41	Mexico 0.77	41	Gabon 14 419	31.1	88.4	85.4	41 France	68.3	61.66
	42	Gabon 1.41	42	Saudi Arabia 0.77	42	Chile 14 311	69.3	64.4	52.3	42 Philippines	62.0	61.58
	43	Nigeria 1.44	43	Panama 0.77	43	Romania 14 278	56.4	69.8	59.0	43 Jordan	61.7	61.48
	44	Dominican Republic 1.47	44	Serbia 0.77	44	Mexico 14 258	64.9	63.2	56.6	44 Syrian Arab Republic	61.5	61.44
	45	Swaziland 1.50	45	Malaysia 0.76	45	Malaysia 14 012	29.3	86.6	91.3	45 Singapore	69.1	61.40
	46	Syrian Arab Republic 1.52	46	Libyan Arab Jamahiriya 0.76	46	Bulgaria 13 870	31.2	87.4	84.8	46 Italy	67.8	61.37
	47	Uganda 1.53	47	Trinidad and Tobago 0.76	47	Turkey 13 668	71.1	58.2	55.8	47 Morocco	61.7	61.36
	48	Peru 1.54	48	Belarus 0.76	48	Botswana 13 384	54.3	68.7	62.0	48 China	61.6	61.35
	49	Nicaragua 1.56	49	Russian Federation 0.76	49	Uraguay 13 189	48.1	73.3	65.3	49 Bosnia and Herzegovina	62.2	61.28
	50	Algeria 1.59	50	Kazakstan 0.75	50	Lebanon 13 070	52.3	68.2	64.3	50 Thailand	61.6	61.19
	51	Egypt 1.66	51	Costa Rica 0.74	51	Panama 13 057	77.9	53.3	55.0	51 Congo	62.0	61.11
	52	Guinea 1.67	52	Albania 0.74	52	Belarus 13 040	29.5	88.5	87.4	52 Austria	68.5	61.10
	53	Chad 1.73	53	Lebanon 0.74	53	Mauritius 12 838	46.5	71.8	68.1	53 Brazil	62.1	61.01
	54	Sudan 1.73	54	Venezuela 0.74	54	Venezuela 12 323	34.3	80.9	80.9	54 Portugal	65.4	60.79
	55	Uzbekistan 1.74	55	Bosnia and Herzegovina 0.73	55	Serbia 11 893	79.4	54.7	51.3	55 India	61.8	60.61
	56	Armenia 1.75	56	Georgia 0.73	56	Iran, Islamic Republic of 11 558	52.9	61.9	68.0	56 South Africa	60.9	60.59
	57	Ghana 1.75	57	Ukraine 0.73	57	Kazakstan 11 510	76.7	48.6	59.6	57 Angola	61.6	60.57
	58	Guatemala 1.77	58	Macedonia 0.73	58	Macedonia 11 159	48.8	63.3	71.8	58 Botswana	61.3	60.54
	59	Madagascar 1.79	59	Mauritius 0.73	59	Costa Rica 11 106	35.1	81.3	76.9	59 Poland	64.4	60.30
	60	Georgia 1.82	60	Jamaica 0.73	60	Brazil 10 367	67.4	64.9	49.2	60 Moldova	60.5	59.91
	61	Azerbaijan 1.87	61	Peru 0.73	61	South Africa 10 278	28.8	87.8	84.7	61 Spain	67.1	59.86
	62	Colombia 1.87	62	Ecuador 0.72	62	Azerbaijan 9 638	29.5	88.4	82.2	62 Slovinia	66.7	59.83
	63	Ecuador 1.89	63	Brazil 0.72	63	Colombia 8 959	38.9	75.6	71.4	63 Belarus	62.0	59.45
	64	Tunisia 1.90	64	Armenia 0.72	64	Albania 8 716	55.0	62.5	61.0	64 Namibia	59.5	59.43
	65	Albania 1.91	65	Colombia 0.71	65	Peru 8 629	29.0	86.1	83.5	65 Greece	66.2	59.29
	66	Honduras 1.91	66	Iran, Islamic Republic of 0.71	66	Bosnia and Herzegovina 8 578	26.5	90.4	86.9	66 Sweden	67.9	59.29
	67	Jamaica 1.93	67	Azerbaijan 0.70	67	Dominican Republic 8 433	46.6	72.9	60.8	67 Ukraine	60.1	59.10
	68	Mali 1.93	68	Turkey 0.70	68	Tunisia 8 273	37.0	77.1	72.3	68 Bulgaria	62.1	59.08
	69	El Salvador 2.03	69	Algeria 0.70	69	Ecuador 8 268	68.2	57.3	52.3	69 Iraq	59.3	58.93
	70	Jordan 2.05	70	Jordan 0.70	70	Algeria 8 172	76.7	60.7	43.7	70 Tajikistan	60.4	58.84
	71	Papua New Guinea 2.14	71	Tunisia 0.70	71	Thailand 7 995	84.1	50.4	47.8	71 Pakistan	60.8	58.76
	72	Namibia 2.15	72	Sri Lanka 0.69	72	Jamaica 7 633	33.1	81.0	75.6	72 Lithuania	63.2	58.72
Lower-middle quadrant	73	China 2.21	73	Dominican Republic 0.69	73	Turkmenistan 7 242	34.7	75.5	76.9	73 Russian Federation	62.4	58.62
	74	South Africa 2.32	74	China 0.69	74	China 6 828	25.1	91.0	88.1	74 Netherlands	68.1	58.59
	75	Niger 2.35	75	Turkmenistan 0.69	75	El Salvador 6 629	70.4	61.5	45.9	75 Kyrgyzstan	59.3	58.35
	76	Thailand 2.37	76	Thailand 0.68	76	Namibia 6 410	67.2	59.3	49.7	76 Viet Nam	58.7	58.27
	77	Serbia 2.39	77	El Salvador 0.67	77	Ukraine 6 318	24.6	90.8	88.1	77 Ireland	67.9	58.19
	78	Bolivia 2.57	78	Gabon 0.67	78	Angola 5 812	60.6	57.4	56.5	78 Guatemala	58.2	58.14
	79	Argentina 2.60	79	Paraguay 0.67	79	Egypt 5 673	65.2	52.2	57.4	79 Swaziland	58.3	58.03
	80	Mauritania 2.61	80	Bolivia 0.66	80	Jordan 5 597	58.4	62.5	53.5	80 Honduras	58.1	58.02
	81	Botswana 2.68	81	Mongolia 0.65	81	Armenia 5 279	61.0	64.1	49.3	81 Uzbekistan	58.1	57.77
	82	Iran, Islamic Republic of 2.68	82	Moldova 0.65	82	Swaziland 4 998	27.3	86.5	81.3	82 Czech Republic	65.0	57.67
	83	Costa Rica 2.69	83	Egypt 0.64	83	Georgia 4 774	25.2	88.2	86.0	83 Finland	66.5	57.63
	84	Turkey 2.70	84	Philippines 0.64	84	Sri Lanka 4 772	30.4	77.0	80.1	84 Saudi Arabia	62.5	57.23
	85	Romania 2.71	85	Uzbekistan 0.64	85	Syrian Arab Republic 4 730	35.7	72.8	71.2	85 Mauritius	59.9	56.97
	86	Bosnia and Herzegovina 2.75	86	Botswana 0.63	86	Guatemala 4 720	50.0	66.3	55.6	86 Bolivia	57.3	56.90
	87	Panama 2.87	87	Syrian Arab Republic 0.63	87	Paraguay 4 523	64.1	58.9	48.0	87 Nicaragua	57.0	56.61
	88	Venezuela 2.89	88	Honduras 0.63	88	Morocco 4 494	22.3	92.9	87.7	88 Australia	67.6	56.60
	89	Lebanon 2.90	89	Namibia 0.63	89	Bolivia 4 419	31.9	76.1	72.5	89 Malaysia	60.2	56.06
	90	Ukraine 2.90	90	South Africa 0.63	90	Congo 4 238	33.9	74.5	69.6	90 Kazakstan	59.3	56.00
	91	Brazil 2.91	91	Indonesia 0.62	91	Indonesia 4 199	90.3	50.0	38.9	91 Bangladesh	59.7	55.99
	92	Hungary 2.99	92	Kyrgyzstan 0.62	92	Honduras 3 842	75.9	52.3	43.3	92 Cambodia	57.2	55.60
	93	Mexico 3.00	93	Tajikistan 0.61	93	Iraq 3 548	78.5	46.2	47.0	93 Yemen	57.2	55.46
	94	Libyan Arab Jamahiriya 3.05	94	Viet Nam 0.59	94	Philippines 3 542	30.4	78.3	71.6	94 Uraguay	60.1	55.45
	95	Trinidad and Tobago 3.09	95	Nicaragua 0.59	95	Mongolia 3 522	21.6	90.8	87.1	95 Canada	66.5	55.44
	96	Paraguay 3.19	96	Morocco 0.58	96	India 3 296	69.7	52.4	45.7	96 Lao People's Democratic Republic (Laos)	55.9	55.07
	97	Chile 3.24	97	Guatemala 0.57	97	Viet Nam 2 953	27.7	80.5	74.8	97 Latvia	61.0	55.07
	98	Gambia 3.45	98	Iraq 0.57	98	Uzbekistan 2 875	75.6	48.2	45.4	98 Cameroon	56.4	54.89
	99	Nepal 3.56	99	India 0.55	99	Moldova 2 854	38.0	68.6	62.8	99 Turkmenistan	56.5	54.69
	100	Croatia 3.75	100	Ghana 0.54	100	Nicaragua 2 641	43.9	66.5	55.9	100 Paraguay	55.4	54.64
	101	Belarus 3.80	101	Congo 0.53	101	Pakistan 2 609	73.8	50.9	40.4	101 Kenya	55.0	53.34
	102	Turkmenistan 3.93	102	Lao People's Democratic Rep 0.52	102	Yemen 2 470	100.0	49.5	30.6	102 Timor-Leste	60.0	53.30
	103	Slovakia 4.06	103	Cambodia 0.52	103	Kyrgyzstan 2 283	17.8	91.0	89.9	103 United States of America	66.2	52.63
	104	Bulgaria 4.07	104	Swaziland 0.52	104	Papua New Guinea 2 281	74.3	45.9	42.5	104 Senegal	54.2	52.54
	105	Mauritius 4.26	105	Kenya 0.51	105	Lao People's Democratic Rep 2 255	87.7	45.4	35.8	105 Haita	56.3	52.25
	106	Poland 4.35	106	Pakistan 0.50	106	Sudan 2 210	27.6	72.8	69.2	106 Macedonia	56.5	51.81
	107	Russian Federation 4.41	107	Bangladesh 0.50	107	Cameroon 2 205	66.4	45.9	45.4	107 Nigeria	52.6	51.71
	108	Portugal 4.47	108	Timor-Leste 0.50	108	Nigeria 2 203	17.8	88.6	86.5	108 Belgium	64.3	51.48
Bottom quadrant	109	Kazakstan 4.54	109	Angola 0.49	109	Tajikistan 1 972	90.3	39.8	37.9	109 Afganistan	56.0	51.43
	110	Lithuania 4.67	110	Cameroon 0.48	110	Mauritania 1 929	79.4	43.0	39.0	110 Zambia	53.8	51.08
	111	Japan 4.73	111	Madagascar 0.48	111	Cambodia 1 915	74.8	45.0	39.4	111 Lesotho	53.1	51.00
	112	Israel 4.82	112	Papua New Guinea 0.47	112	Senegal 1 817	66.9	54.1	40.2	112 Ghana	51.7	50.98
	113	Malaysia 4.86	113	Tanzania 0.47	113	Cote d'Ivoire 1 701	16.9	89.5	87.0	113 Denmark	64.5	50.87
	114	Korea (South) 4.87	114	Yemen 0.46	114	Kenya 1 573	72.0	46.6	38.3	114 Tanzania	52.3	50.48
	115	New Zealand 4.89	115	Nigeria 0.46	115	Ghana 1 552	76.5	40.0	41.6	115 Cote d'Ivoire	52.7	50.28
	116	United Kingdom 4.89	116	Senegal 0.46	116	Benin 1 508	70.9	42.7	39.8	116 Benin	51.1	49.38
	117	Italy 4.99	117	Nepal 0.46	117	Lesotho 1 468	18.2	83.5	77.5	117 Estonia	59.7	49.05
	118	France 5.01	118	Haita 0.45	118	Zambia 1 430	55.2	46.6	45.9	118 Papua New Guinea	49.2	49.04
	119	Switzerland 5.02	119	Mauritania 0.45	119	Bangladesh 1 416	76.2	42.9	35.6	119 Rwanda	51.6	48.84
	120	Germany 5.08	120	Lesotho 0.45	120	Gambia 1 415	61.2	40.8	45.4	120 Sudan	49.1	48.40
	121	Saudi Arabia 5.13	121	Uganda 0.45	121	Tanzania 1 362	77.6	43.5	31.4	121 Togo	50.8	47.32
	122	Uraguay 5.13	122	Togo 0.44	122	Afganistan 1 321	64.7	44.6	36.7	122 Uganda	48.6	47.29
	123	Austria 5.30	123	Zambia 0.43	123	Chad 1 300	85.7	40.0	30.4	123 Malawi	52.0	47.05
	124	Slovinia 5.30	124	Rwanda 0.43	124	Uganda 1 217	60.2	48.0	33.8	124 Madagascar	47.4	46.08
	125	Singapore 5.34	125	Benin 0.43	125	Burkino Faso 1 187	49.6	45.3	43.4	125 Mauritania	46.1	46.02
	126	Greece 5.39	126	Gambia 0.42	126	Mali 1 185	28.3	65.3	52.2	126 Mongolia	48.6	45.86
	127	Spain 5.42	127	Sudan 0.41	127	Nepal 1 155	77.9	35.3	34.8	127 Guinea-Bissau	49.3	45.73
	128	Mongolia 5.53	128	Cote d'Ivoire 0.40	128	Haita 1 151	74.0	36.3	32.8	128 Ethiopia	47.7	44.49
	129	Norway 5.56	129	Malawi 0.40	129	Rwanda 1 136	84.1	32.2	32.0	129 Mozambique	49.4	44.25
	130	Latvia 5.64	130	Afganistan 0.40	130	Guinea-Bissau 1 071	10.1	83.1	100.0	130 Qatar	64.4	43.75
	131	Macedonia 5.66	131	Ethiopia 0.36	131	Guinea 1 048	68.9	33.1	36.3	131 Burkino Faso	46.1	43.57
	132	Czech Republic 5.73	132	Mali 0.36	132	Madagascar 1 004	75.4	33.6	30.6	132 Sierra Leone	46.5	42.65
	133	Sweden 5.88	133	Guinea-Bissau 0.35	133	Ethiopia 934	9.6	84.6	93.3	133 United Arab Emirates	62.5	42.35
	134	Finland 6.16	134	Eritrea 0.35	134	Mozambique 885	58.1	35.9	36.3	134 Mali	43.4	42.29
	135	Netherlands 6.19	135	Guinea 0.34	135	Togo 850	61.2	32.8	37.6	135 Chad	43.9	42.27
	136	Ireland 6.29	136	Central African Republic 0.34	136	Sierra Leone 808	62.2	34.4	34.5	136 Guinea	43.7	41.93
	137	Australia 6.84	137	Sierra Leone 0.34	137	Timor-Leste 805	80.0	34.9	25.8	137 Eritrea	46.9	41.62
	138	Canada 7.01	138	Burkino Faso 0.33	138	Malawi 794	68.9	34.3	29.7	138 Central African Republic	44.3	41.24
	139	Estonia 7.88	139	Liberia 0.33	139	Central African Republic 757	41.6	42.0	38.9	139 Gambia	40.8	40.81
	140	Belgium 8.00	140	Chad 0.33	140	Niger 690	40.8	45.8	35.9	140 Nepal	40.8	40.61
	141	United States of America 8.00	141	Mozambique 0.32	141	Eritrea 581	79.7	31.6	20.0	141 Burundi	43.8	36.96
	142	Denmark 8.26	142	Burundi 0.32	142	Liberia 396	70.2	32.9	20.2	142 Liberia	41.1	35.99
	143	Qatar 10.51	143	Niger 0.30	143	Burundi 392	52.5	29.5	28.3	143 Niger	36.8	35.28
	144	United Arab Emirates 10.68	144	Congo, Democratic Republic 0.29	144	Congo, Democratic Republic 319	84.9	28.6	17.0	144 Congo, Democratic Republic of	43.5	34.57

Appendix V: Global Composite Sustainable Development index

Table 22: Global Composite Sustainable Development index

GLOBAL COMPOSITE SUSTAINABLE DEVELOPMENT (n=79) - COUNTRIES NORMALIZED SCORES

	ENVIRONMENT / PLANET					SOCIAL / PEOPLE						ECONOMIC / PROSPERITY					SD COMPOSITES				RESEARCH INDEXES						
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Extra 27	21	22	23	24	25	26
Country	EF	EPI	ESI	EW	EWI	HDI	IHDI	QLI	Gini	HW	HWI	GDP	GNI	ANS	GCI	EcW	LPrI	HPI	SSI	WI	C3Pi	ENVi	SOCi	ECOi	TBLi	SDCi	GCSDi
1 Switzerland	31.0	76.7	63.7	53.6	43.0	90.3	84.0	80.7	60.5	90.8	78.0	89.7	85.8	78.6	81.7	86.3	93.6	61.8	73.6	60.5	63.1	51.1	80.0	84.3	70.1	71.2	70.7
2 Norway	28.1	69.9	73.4	37.0	43.0	94.3	89.0	80.5	83.1	94.4	82.0	92.9	88.3	68.1	75.3	80.5	100.0	63.2	63.8	62.5	62.7	47.0	87.0	80.5	69.1	70.9	70.0
3 Sweden	26.5	68.8	71.7	42.0	49.0	90.4	85.1	79.4	89.4	94.1	79.0	86.9	84.2	71.9	79.0	82.6	95.9	56.1	67.3	64.0	59.3	48.5	86.0	80.8	69.6	69.4	69.5
4 Austria	29.5	68.9	62.7	44.7	42.0	88.5	82.0	72.7	80.2	92.1	80.0	87.4	84.2	70.7	74.6	70.4	87.0	57.4	65.6	61.0	61.1	47.4	82.3	77.2	67.0	66.9	66.9
5 Finland	25.2	64.4	75.1	34.3	44.0	88.2	83.3	76.2	77.9	94.0	81.0	86.0	82.8	62.6	79.3	75.3	94.7	50.8	60.9	62.5	57.6	45.0	83.2	76.7	66.0	65.4	65.7
6 Germany	30.7	66.9	56.9	33.6	36.0	90.5	84.2	70.5	77.3	89.7	77.0	86.5	83.8	66.5	78.3	58.0	87.6	57.5	55.6	56.5	62.2	42.7	81.2	73.8	63.5	63.1	63.3
7 United Kingdom	31.8	68.8	50.2	37.8	30.0	86.3	79.1	69.2	59.9	87.8	73.0	86.0	83.2	55.6	77.9	48.6	88.3	58.5	55.2	51.5	61.8	41.6	75.2	68.5	59.8	61.9	60.9
8 Slovinia	29.5	62.3	57.5	37.9	35.0	88.4	83.7	69.9	73.5	87.0	71.0	82.2	79.0	69.1	62.0	74.2	75.6	46.8	61.2	53.0	59.8	42.6	78.5	72.9	62.5	58.2	60.3
9 Costa Rica	48.7	69.0	59.6	69.2	41.0	74.4	59.1	66.2	30.2	66.3	56.0	69.1	66.7	71.0	62.0	46.1	63.7	77.9	61.5	48.5	63.0	56.4	56.5	62.2	58.3	62.0	60.1
10 France	31.1	69.0	55.2	35.4	29.0	88.4	80.4	70.8	62.8	89.7	75.0	85.4	81.9	61.3	73.0	46.8	80.1	56.5	53.8	52.0	61.7	41.4	77.3	68.1	60.2	59.7	59.9
11 Denmark	16.9	63.6	58.2	26.9	31.0	89.5	84.2	78.0	83.7	87.4	81.0	87.0	83.6	65.6	75.6	77.6	96.1	40.5	54.5	56.0	50.9	35.0	83.9	77.5	61.0	58.7	59.9
12 Netherlands	25.1	65.7	53.7	27.7	22.0	91.0	84.6	74.3	67.1	90.7	78.0	88.1	84.5	66.7	78.6	60.7	93.9	51.4	52.6	50.0	58.6	35.2	80.5	75.0	59.6	59.7	59.7
13 Canada	21.6	58.4	64.4	22.1	43.0	90.8	82.9	76.0	64.2	89.3	78.0	87.1	84.0	59.8	75.3	39.2	95.1	52.2	43.1	60.5	55.4	37.8	79.7	66.4	58.5	60.0	59.2
14 Italy	31.2	68.9	50.1	39.3	30.0	87.4	77.9	78.1	64.4	85.7	74.0	84.8	79.9	60.2	63.7	53.6	65.7	56.4	56.9	52.0	61.4	41.8	77.5	67.4	60.2	57.5	58.9
15 Australia	22.3	56.6	61.0	20.0	28.0	92.9	85.6	79.3	68.1	83.8	79.0	87.7	83.7	55.0	73.1	73.0	95.9	49.7	47.3	53.5	56.6	33.6	81.1	73.6	58.5	58.9	58.7
16 Slovakia	37.0	66.6	52.8	37.6	40.0	83.4	78.7	63.8	80.2	87.2	61.0	79.7	75.9	76.4	59.1	69.2	64.6	46.6	60.1	50.5	62.7	45.5	75.0	71.7	62.6	55.0	58.7
17 Czech Republic	27.3	64.8	46.6	28.1	33.0	86.5	82.1	66.3	66.8	87.0	70.0	81.3	76.9	66.4	64.4	79.8	70.6	45.4	55.7	51.5	57.7	37.7	75.9	73.4	59.5	55.1	57.2
18 Argentina	49.7	56.5	62.7	38.3	40.0	79.7	64.1	64.7	37.3	72.3	55.0	73.0	71.3	65.5	43.9	65.8	58.9	66.7	55.7	47.5	66.1	48.5	60.5	62.9	57.0	56.8	56.9
19 Uraguay	30.4	57.1	71.8	35.4	52.0	78.3	65.4	63.7	38.1	76.6	61.0	71.6	70.0	60.2	59.0	67.4	67.0	45.2	55.6	56.5	55.4	47.0	62.2	65.4	57.6	55.5	56.6
20 Ireland	24.6	58.7	59.2	21.8	32.0	90.8	84.3	83.3	60.1	90.1	76.0	88.1	81.4	51.7	70.1	34.3	92.8	50.3	41.6	54.0	58.2	35.9	80.0	61.7	56.2	56.9	56.5
21 Korea (South)	31.9	57.2	43.0	26.8	27.0	89.7	74.9	68.8	66.8	85.9	67.0	82.2	80.8	76.7	73.1	58.8	71.7	52.5	50.5	47.0	61.7	35.5	75.0	73.8	58.2	54.7	56.4
22 Spain	28.8	60.3	48.8	31.5	20.0	87.8	79.9	77.3	64.4	82.5	73.0	84.7	79.9	64.5	65.7	49.8	75.7	53.0	50.7	46.5	59.9	35.1	77.1	67.8	56.8	55.4	56.1
23 Latvia	27.7	70.4	60.4	53.8	46.0	80.5	71.7	60.1	57.2	76.5	62.0	74.8	71.1	77.1	62.1	65.9	52.7	37.3	64.6	54.0	55.1	49.3	67.4	70.0	61.5	51.2	56.1
24 Panama	46.9	57.9	57.7	49.0	37.0	76.8	57.9	63.6	27.9	63.8	52.0	71.5	69.0	86.6	64.1	45.5	58.3	71.1	53.1	44.5	63.6	49.1	54.5	65.9	56.1	55.9	56.0
25 Poland	35.1	63.5	45.0	33.7	30.0	81.3	73.4	63.1	59.4	85.0	65.0	76.9	73.9	64.5	63.7	61.1	65.9	50.6	55.4	47.5	60.3	39.9	70.6	67.7	57.6	54.4	56.0
26 Portugal	34.3	57.6	54.2	39.5	31.0	80.9	72.6	73.1	50.5	86.3	72.0	80.9	76.3	50.8	62.9	37.6	72.5	44.2	52.3	51.5	60.8	42.0	71.6	59.4	56.3	54.2	55.3
27 Sri Lanka	71.3	55.7	48.5	64.9	57.0	69.1	57.9	64.2	32.2	70.4	40.0	56.7	55.9	72.4	59.9	42.1	48.0	60.6	60.1	48.5	65.4	59.0	53.4	56.5	56.3	54.0	55.1
28 Belgium	17.8	63.0	44.4	24.8	23.0	88.6	81.9	71.0	74.5	88.5	80.0	86.5	83.2	68.6	74.4	50.9	82.9	41.4	47.9	51.5	51.5	31.0	80.5	71.5	56.3	53.9	55.1
29 Peru	64.5	50.3	60.4	44.9	62.0	72.5	55.7	62.2	37.0	62.2	44.0	65.4	63.4	63.2	61.1	50.5	43.8	64.5	52.3	53.0	67.4	55.9	54.2	60.5	56.8	52.9	54.8
30 Hungary	45.7	57.1	52.0	34.8	33.0	81.6	75.9	65.3	84.0	86.6	65.0	77.9	73.2	58.3	61.4	47.3	60.5	41.9	52.9	49.0	66.2	43.5	75.9	62.7	59.2	50.6	54.7
31 Lithuania	33.1	65.5	58.9	37.0	44.0	81.0	73.0	60.3	56.6	80.9	61.0	75.6	72.9	60.1	63.0	63.7	58.1	36.7	56.8	52.5	58.7	46.1	68.1	66.8	59.4	50.2	54.6
32 Croatia	39.3	64.2	59.5	38.6	33.0	79.6	67.5	63.0	77.3	80.7	57.0	77.7	72.4	67.5	57.7	54.6	52.1	47.4	55.5	45.0	62.4	45.3	70.3	65.4	59.3	49.8	54.4
33 Ecuador	58.7	60.6	52.4	50.9	56.0	72.0	53.5	62.7	34.9	67.8	43.0	64.8	62.0	58.2	56.3	44.2	41.5	64.6	54.7	49.5	64.9	55.6	53.9	56.6	55.4	51.9	53.6
34 Brazil	46.5	60.9	62.2	55.5	36.0	71.8	51.9	64.7	27.9	65.9	45.0	68.1	66.2	58.4	62.9	40.5	56.1	65.2	54.7	40.5	61.0	51.2	52.1	58.2	53.7	53.3	53.5
35 Chile	43.4	55.3	53.6	33.5	30.0	80.5	65.2	67.9	27.6	69.7	55.0	72.8	70.1	56.8	66.4	42.6	65.6	66.4	46.8	42.5	63.4	41.9	57.9	60.6	52.8	54.3	53.5
36 United States of America	17.8	56.6	52.9	27.1	31.0	91.0	77.1	76.2	38.6	82.2	73.0	89.9	86.9	52.0	78.1	30.5	91.0	41.7	42.3	52.0	52.6	33.9	70.6	62.7	53.1	53.8	53.5
37 Albania	58.4	65.9	58.8	61.4	46.0	73.9	63.7	56.3	58.7	79.7	38.0	65.5	62.4	62.7	55.9	32.2	37.2	66.7	57.6	42.0	65.6	57.7	60.1	54.0	57.2	49.5	53.2
38 Colombia	59.0	62.3	58.9	62.6	42.0	71.0	47.9	61.8	25.1	60.6	43.0	65.9	63.3	59.4	59.7	37.8	45.1	73.4	54.5	42.5	65.1	56.4	48.9	56.2	53.7	52.6	53.2
39 Israel	32.2	54.6	50.9	20.1	25.0	88.8	77.9	64.9	49.1	79.5	59.0	82.5	79.6	67.4	71.7	50.4	59.5	68.0	42.3	42.0	61.8	33.9	68.5	69.3	54.4	51.8	53.1
40 Indonesia	71.3	52.3	48.8	53.5	48.0	61.7	50.4	58.1	53.9	64.3	36.0	54.8	51.8	66.0	62.9	39.6	47.0	68.4	53.2	42.0	62.3	54.2	53.2	54.2	53.8	51.8	52.8
41 Estonia	18.2	56.1	58.2	22.5	34.0	83.5	76.9	59.1	66.1	82.8	62.0	77.5	73.4	70.0	66.3	74.8	65.5	37.3	49.6	48.0	49.1	34.0	71.1	72.3	55.9	49.1	52.4
42 Dominican Republic	65.8	52.4	43.7	60.2	46.0	68.9	51.0	56.3	33.1	60.0	49.0	65.0	62.9	53.4	53.9	51.0	39.0	62.3	57.7	47.5	66.6	53.0	51.8	57.0	53.9	50.8	52.3
43 Romania	48.5	48.3	46.2	39.9	30.0	78.1	68.3	61.1	61.4	73.7	50.0	72.8	67.4	75.2	58.1	56.6	47.5	50.0	54.8	40.0	65.1	41.9	64.8	65.6	56.3	47.8	51.8
44 Viet Nam	67.2	50.6	42.3	49.8	49.0	59.3	51.0	60.8	52.2	64.7	28.0	49.7	47.8	72.6	58.7	38.4	50.4	74.0	51.5	38.5	58.3	51.2	50.9	52.2	51.4	52.2	51.8
45 Thailand	52.3	60.0	49.7	52.2	23.0	68.2	53.7	64.4	25.4	68.0	50.0	64.3	62.2	77.3	64.6	46.8	49.6	65.9	56.0	36.5	61.2	45.1	52.3	62.2	52.7	50.8	51.8
46 Venezuela	46.7	55.6	48.1	42.8	46.0	73.5	54.0	60.9	49.5	64.7	43.0	70.6	66.9	56.4	49.4	41.3	40.5	70.0	49.6	44.5	62.3	47.7	56.7	55.9	53.2	50.0	51.6
47 Philippines	69.3	57.4	42.3	52.1	32.0	64.4	51.6	64.0	37.3	68.7	44.0	52.3	50.8	86.1	60.4	42.0	45.2	64.5	54.8	38.0	61.6	48.9	53.7	56.6	53.0	49.6	51.3
48 Greece	29.0	60.0	50.1	28.4	33.0	86.1	75.6	71.6	62.1	84.7	70.0	83.5	78.3	43.6	55.1	29.5	52.4	47.3	43.2	51.5	59.3	38.2	74.6	54.1	53.6	48.5	51.0
49 Jamaica	58.1	54.4	44.7	41.7	35.0	72.7	61.0	60.2	37.8	66.8	54.0	63.6	59.8	61.1	54.9	25.6	47.0	71.9	44.1	44.5	64.5	46.0	57.6	50.4	51.1	50.7	50.9
50 Armenia	60.9	47.5	53.2	41.0	55.0	71.6	63.9	54.2	67.1	67.9	45.0	58.2	56.6	64.3	57.4	31.4	33.6	55.8	46.3	50.0	63.3	51.1	60.9	52.0	54.5	45.6	49.9
51 Mexico	45.6	49.1	46.2	40.7	21.0	77.0	58.9	67.7	28.1	62.9	45.0	72.8	70.0	63.7	62.3	59.4	47.4	65.2	52.7	33.0	63.5	38.8	53.9	65.4	51.5	48.1	49.8
52 El Salvador	56.7	52.1	43.8	48.3	46.0	67.4	49.5	61.6	35.5	62.8	36.0	61.5	58.5	57.3	54.3	37.5	37.5	72.3	50.0	41.0	61.7	49.2	50.5	53.0	50.9	48.5	49.7
53 Bulgaria	37.0	56.3	50.0	34.1	31.0	77.1	68.3	61.6	38.1	81.4	58.0	72.3	67.8	60.2	61.0	47.4	52.6	35.7	51.3	44.5	59.1	40.6	62.3	61.1	53.7	45.5	49.4
54 Georgia	59.8	56.8	51.5	52.9	41.0	73.3	63.0	53.7	46.1	65.1	48.0	56.7	55.4	44.5	58.1	30.6	36.6	55.8	49.9	44.5	62.9	52.0	57.4	47.8	52.2	46.1	49.1
55 Tunisia	58.5	46.7	51.8	30.1	32.0	69.8	52.3	54.7	47.6	74.2	44.0	64.8	61.4	70.3	63.9	45.6	41.0	59.1	47.1	38.0	64.2	42.4	56.1	60.5	52.4	45.6	48.9
56 Paraguay	43.9	52.4	59.7	54.3	46.0	66.5	50.5	57.6	26.0	56.3	35.0	55.9	55.2	59.1	52.4	41.2	45.1	55.5	51.3	40.5	54.6	50.9	46.3	52.4	49.8	47.8	48.8
57 Nicaragua	64.1	59.2	50.2	71.0	49.0	58.9	42.7	56.6	46.6	52.6	28.0	48.0	45.7	57.0	53.3	30.7	37.5	70.3	51.4	38.5	56.6	58.1	46.2	45.9	49.8	47.8	48.8
58 Honduras	58.4	52.5	47.4	64.9	45.0	62.5	42.7	52.5	19.8	56.4	33.0	53.5	50.7	64.2	55.4	42.4	35.7	69.0	55.3	39.0	58.0	53.2	41.6	52.8	48.9	48.0	48.4
59 Kyrgyzstan	70.4	46.3	48.4	52.0	42.0	61.5	52.6	48.5	61.2	65.3	38.0	45.9	43.2	64.1	49.1	32.4	37.7	60.2	50.3	40.0	58.4	51.0	53.6	45.8	50.0	46.2	48.1
60 Moldova	67.4	45.2	51.2	34.7	35.0	64.9	56.9	50.1	51.4	68.7	41.0	49.2	49.0	72.2	56.3	48.3	38.2	58.6	48.7	38.0	59.9	45.2	54.7	54.3	51.2	45.1	48.1
61 Bolivia	50.0	54.6	59.5	55.6	63.0	66.3	43.7	54.9	19.2	52.6	34.0	55.6	53.0	60.3	54.0	38.9	36.5	52.2	49.8	48.5	56.9	56.4	42.0	51.8	49.7	46.3	48.0
62 Turkey	48.6	44.8	46.6	31.3	28.0	69.9	54.2	62.9	47.2	68.5	45.0	72.1	68.9	56.4	63.6	52.1	37.5	58.1	47.7	36.5	62.6	38.9	57.1	62.2	51.7	44.1	47.8
63 Guatemala	60.6	51.9	44.0	74.2	44.0	57.4	39.3	53.2	23.3	56.2	23.0	56.5	53.4	57.7	57.3	38.9	35.3	70.0	56.9	33.5	58.1	53.8	39.2	52.2	47.9	46.6	47.3
64 China	54.3	42.2	38.6	40.1	28.0	68.7	53.4	60.8	22.1	58.4	36.0	62.0	61.8	100.0	69.0	45.0	49.9	53.9	47.5	32.0	61.4	39.8	46.7	65.3	49.5	45.0	47.2
65 Russian Federation	34.7	45.4	56.1	26.4	42.0	75.5	67.0	48.0	43.9	70.5	48.0	76.9	71.3	52.0	60.0	43.9	45.5	36.5	43.3	45.0	58.6	39.7	57.5	59.6	51.4	42.4	46.7
66 Morocco	71.1	45.8	44.8	31.8	32.0	58.2	40.9	60.2	45.9	66.1	36.0	55.8	53.5	82.6	59.3	35.8	43.8	58.5	43.1	34.0	61.4	43.1	50.0	55.4	49.2	44.0	46.6
67 Azerbaijan	59.0	43.1	45.4	38.3	28.0	70.0	62.0	53.8	60.5	64.5	42.0	67.0	63.9	59.4	63.0	43.0	36.5	47.9	47.9	35.0	65.2	41.5	58.0	58.6	52.1	41.4	46.4
68 Ukraine	46.6	46.3	44.7	28.3	26.0	72.9	66.2	50.3	75.9	70.3	47.0	60.8	59.1	59.6	59.1	43.3	44.6	42.3	44.2	36.5	59.1	37.2	62.7	55.9	50.7	41.8	46.0
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70 Kazakstan	33.9	32.9	48.6	23.4	32.0	74.5	65.6	50.8	78.1	71.6	43.0	69.6	66.8	51.5	62.6	36.6	54.4	36.9	39.8	37.5	56.0	33.2	62.5	56.0	48.8	41.6	45.1
71 Egypt	62.4	55.2	44.0	29.3	43.0	64.4	48.9	56.1	59.0	74.5	39.0	59.2	56.8	56.6	53.3	39.6	29.0	45.8	44.8	41.0	62.0	45.3	55.8	52.6	51.0	39.5	44.9
72 Tajikistan	76.7	38.8	38.6	45.3	39.0	60.7	50.0	47.5	63.0	59.1	28.0	43.7	42.4	60.3	54.3	27.8	37.8	58.4	44.3	33.5	58.8	45.9	49.7	44.2	46.5	42.5	44.5
73 Jordan	56.4	42.2	47.8	21.5	28.0	69.8	56.5	56.8	48.1	70.3	38.0	59.0	56.9	56.5	60.4	27.1	41.5	63.6	35.5	33.0	61.5	36.9	55.4	49.9	46.7	41.9	44.3
74 Macedonia	27.6	47.0	47.2	35.1	42.0	72.8	60.9	53.4	40.0	68.8	46.0	69.2	64.1	66.7	57.7	50.4	42.0	23.3	49.4	44.0	51.8	39.0	55.7	61.2	51.1	38.2	44.1
75 India	79.4	36.2	45.2	47.5	27.0	54.7	39.2	57.6	53.9	51.2	31.0	51.3	50.8	81.5	61.7	30.3	31.5	62.6	43.7	29.0	60.6	44.1	46.8	52.4	47.7	39.8	43.5
76 Ghana	60.9	47.5	52.8	71.6	38.0	54.1	38.7	51.7	48.7	51.9	22.0	40.2	39.6	47.4	54.1	29.3	37.7	46.9	50.7	30.0	51.0	52.9	42.3	41.3	45.2	40.5	42.8
77 Tanzania	72.0	54.3	50.3	83.4	54.0	46.6	33.2	45.0	52.2	46.9	18.0	38.3	37.0	69.0	51.4	24.6	26.7	28.7	49.5	36.0	50.5	61.6	38.1	41.5	46.0	34.2	39.7
78 Pakistan	84.1	39.6	39.9	49.5	44.0	50.4	34.6	52.3	67.8	51.4	18.0	47.8	46.4	65.6	50.3	32.4	11.1	66.7	45.2	31.0	58.8	49.2	42.3	47.3	46.2	31.9	38.4
79 South Africa	52.9	34.6	46.2	29.6	27.0	61.9	41.1	52.5	10.8	62.2	43.0	68.0	65.2	53.4	62.4	29.6	43.3	23.0	39.1	35.0	60.6	36.8	39.6	53.5	42.7	34.2	38.2
Maximum (top) score	90.3	76.7	75.1	83.4	63.0	94.3	89.0	83.3	89.4	94.4	82.0	92.9	88.3	100.0	81.7	86.3	100.0	77.9	73.6	64.0	67.4	61.6	87.0	84.3	70.1	71.2	70.7
Minimum (bottom) score	16.9	32.9	38.6	20.0	20.0	46.6	33.2	45.0	10.8	46.9	18.0	38.3	37.0	43.6	43.9	24.6	11.1	23.0	35.5	29.0	49.1	31.0	38.1	41.3	42.7	31.9	38.2
Mean (average) score	46.3	55.7	52.4	41.7	37.7	75.1	63.3	62.9	52.4	73.1	52.7	69.4	66.6	64.4	62.5	48.0	56.3	55.1	51.7	45.2	60.1	45.1	61.9	61.1	54.9	50.9	52.8
South Africa score	52.9	34.6	46.2	29.6	27.0	61.9	41.1	52.5	10.8	62.2	43.0	68.0	65.2	53.4	62.4	29.6	43.3	23.0	39.1	35.0	60.6	36.8	39.6	53.5	42.7	34.2	38.2
Top country	Bangladesh	Switzerland	Finland	Tanzania	Bolivia	Norway	Norway	Ireland	Norway	Norway	Norway	Norway	Norway	China	Switzerland	Switzerland	Norway	Costa Rica	Switzerland	Sweden	Peru	Tanzania	Norway	Switzerland	Switzerland	Switzerland	Switzerland
Bottom country	Denmark	Kazakstan	China	Australia	Spain	Tanzania	Tanzania	Tanzania	South Africa	Tanzania	Tanzania	Tanzania	Tanzania	Greece	Argentina	Tanzania	Pakistan	South Africa	Jordan	India	Estonia	Belgium	Tanzania	Ghana	South Africa	Pakistan	South Africa
			Tajikistan								Pakistan																

Appendix VI: Stark Contrasts – Indices Ranking by Country

Table 23: Stark Contrasts – Indices Ranking by Country

RANKING VARIANCE (Maximum Rank minus Minimum Rank) - Highest to Lowest

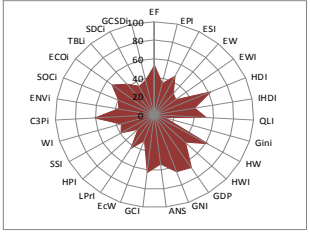
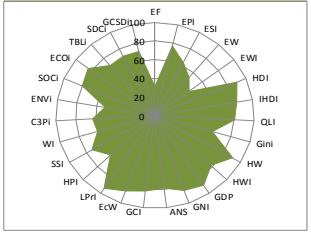
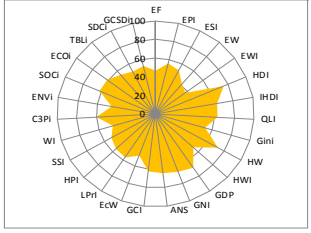
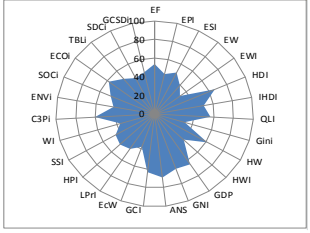
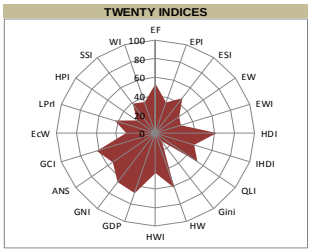
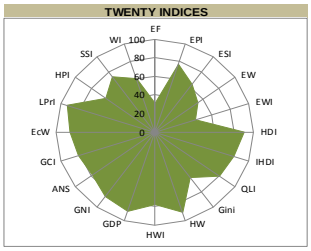
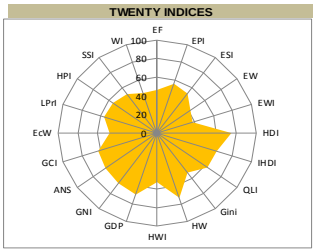
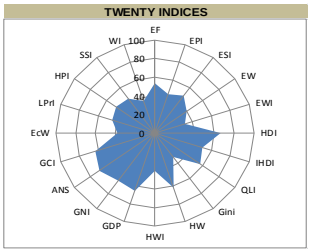
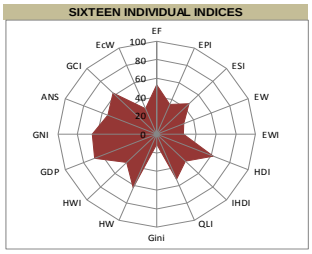
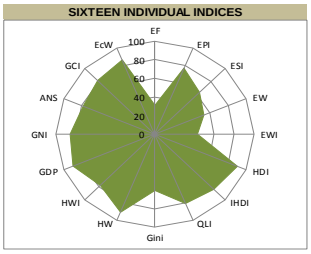
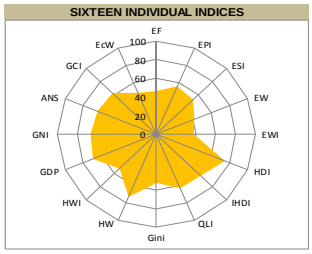
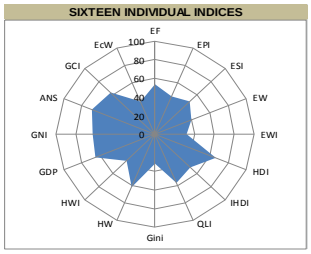
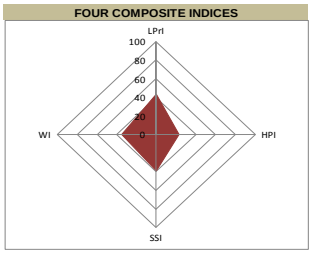
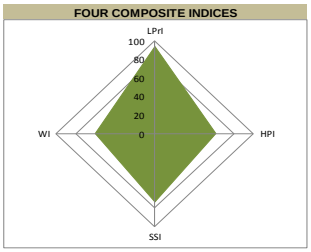
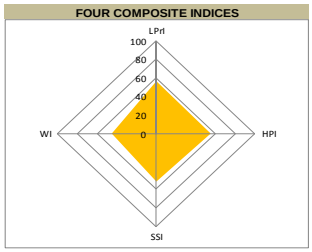
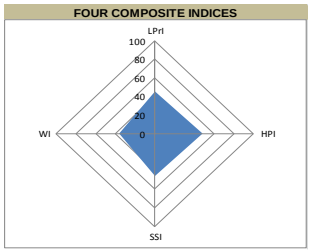
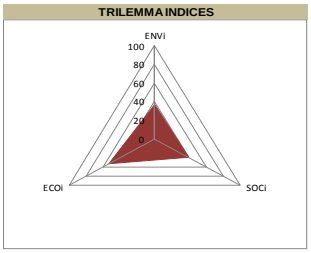
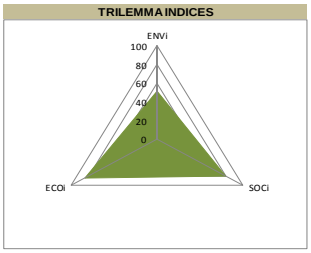
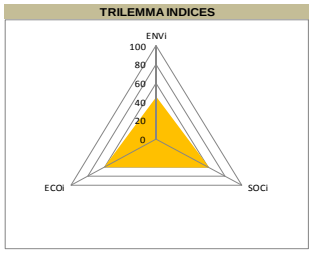
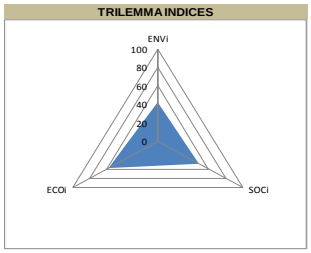
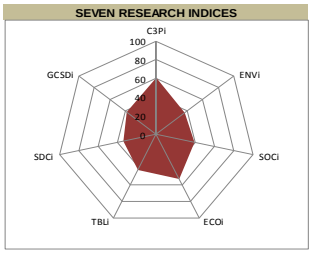
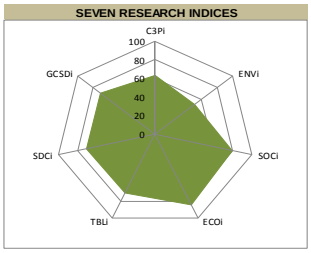
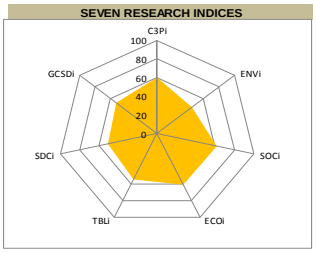
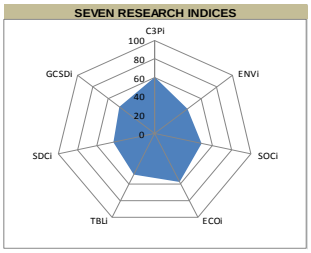
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Tanzania	5	50	41	1	6	79	79	79	42	79	78	79	79	22	75	79	78	77	52	68	78	1	79	78	77	77	77	60	79	1	78	2	8
Australia	74	38	10	79	65	2	2	5	14	23	7	6	9	69	13	9	4	55	59	12	66	77	7	10	19	12	15	28	79	2	77	2	1
Bangladesh	1	72	69	24	18	78	77	58	27	73	75	78	78	4	74	63	76	10	62	67	68	15	72	74	71	66	69	56	78	1	77	1	3
Bolivia	33	48	16	11	1	62	69	62	78	75	69	66	66	46	69	55	71	49	49	31	64	6	75	69	66	56	61	53	78	1	77	1	1
China	30	73	78	36	67	58	56	46	76	69	66	55	53	1	18	40	40	45	58	76	37	58	69	30	67	63	64	53	78	1	77	1	1
Denmark	79	18	21	69	55	11	7	7	3	13	3	9	10	32	8	5	2	70	29	9	77	73	3	4	10	13	11	24	79	2	77	1	1
Pakistan	2	75	77	23	23	77	78	71	15	77	79	74	73	33	76	66	79	16	64	77	53	24	73	73	76	79	78	60	79	2	77	1	3
Ghana	18	61	34	3	38	76	76	72	47	76	77	77	77	77	68	75	63	59	44	78	76	14	74	79	78	73	76	62	79	3	76	1	1
Guatemala	19	56	70	2	22	74	74	68	75	72	76	63	65	60	59	56	73	9	14	72	60	11	78	66	72	55	63	55	78	2	76	1	1
India	3	77	63	27	71	75	75	54	40	78	71	70	69	6	40	72	75	26	69	79	42	43	68	64	73	74	75	58	79	3	76	1	1
United States of America	78	39	32	68	57	4	21	10	56	26	17	2	2	72	6	71	10	68	74	18	73	76	25	32	46	29	36	39	78	2	76	2	1
Argentina	34	40	8	41	36	31	38	29	60	37	34	32	31	34	79	14	30	14	18	33	4	29	37	31	26	17	18	31	79	4	75	1	1
Ireland	73	29	17	76	50	6	5	1	32	7	12	4	15	74	17	64	9	53	76	10	59	69	10	37	33	16	20	32	76	1	75	1	2
Tajikistan	4	76	79	28	37	70	65	78	24	68	74	76	76	47	67	76	62	35	66	73	52	36	66	77	75	67	72	60	79	4	75	1	1
Belgium	77	20	68	72	75	13	14	16	12	11	5	12	11	23	12	26	14	69	55	22	75	79	8	15	31	28	28	33	79	5	74	1	1
Netherlands	72	13	29	67	77	3	4	12	16	6	9	5	4	27	4	17	7	50	36	25	56	71	9	7	14	10	12	25	77	3	74	1	1
Jamaica	27	49	66	33	43	46	43	49	59	51	36	54	55	45	65	78	45	5	68	42	11	35	41	70	58	40	49	47	78	5	73	1	1
Philippines	10	33	76	19	51	64	60	32	61	45	50	69	68	3	44	48	48	23	26	60	33	27	56	48	47	45	47	44	76	3	73	1	1
Viet Nam	12	57	75	22	9	71	62	47	41	57	72	71	72	13	53	57	39	2	39	58	58	18	63	67	55	33	44	47	75	2	73	1	1
Estonia	76	42	22	74	45	23	22	52	20	24	26	27	26	20	20	7	25	72	50	32	79	74	24	13	35	47	41	38	79	7	72	1	1
Kazakstan	52	79	50	73	54	39	35	73	7	38	55	41	41	75	34	61	34	73	77	63	67	78	33	52	70	71	70	55	79	7	72	1	1
Nicaragua	15	28	43	4	10	72	70	57	51	74	73	73	74	62	71	69	67	7	40	59	65	3	71	75	65	53	57	52	75	3	72	1	1
Colombia	21	21	19	8	29	51	68	41	74	66	53	47	48	54	48	58	49	3	30	47	8	5	67	51	42	32	38	40	74	3	71	1	1
Dominican Republic	13	52	73	10	14	57	61	60	65	67	40	50	49	70	70	25	60	27	11	35	2	13	62	47	39	39	42	43	73	2	71	1	1
Spain	65	25	48	59	79	18	16	8	22	25	16	17	17	35	21	30	16	46	43	37	46	72	16	20	27	20	22	32	79	8	71	1	1
Canada	75	30	5	75	26	5	11	11	23	10	10	8	7	52	10	54	5	48	72	6	70	64	12	24	20	9	13	28	75	5	70	3	2
Finland	71	16	1	53	20	17	10	9	8	3	2	13	13	43	2	6	6	51	8	3	63	42	4	6	5	5	5	18	71	1	70	1	1
Honduras	26	51	55	7	19	66	71	69	77	70	70	68	70	38	63	46	72	11	23	57	61	12	76	62	69	51	58	53	77	7	70	1	1
Armenia	17	62	31	34	5	50	39	64	17	49	46	60	60	37	58	68	74	42	63	26	16	20	36	68	37	60	50	44	74	5	69	1	1
Kyrgyzstan	9	65	52	20	30	69	57	76	29	55	62	75	75	39	78	65	64	30	46	56	57	21	57	76	63	57	59	53	78	9	69	1	1
Latvia	67	2	11	14	12	29	29	51	37	33	25	31	32	9	37	13	35	71	4	11	71	23	30	16	9	37	23	28	71	2	69	1	2
Sweden	70	8	4	32	8	8	3	4	1	2	6	10	5	16	3	2	3	41	2	1	49	28	2	2	2	3	3	12	70	1	69	2	1
Venezuela	39	44	53	31	15	42	53	45	45	58	54	40	40	66	77	49	59	8	51	41	24	30	45	54	45	43	46	44	77	8	69	1	1
El Salvador	28	55	72	26	16	60	66	42	63	63	65	56	57	61	66	60	66	4	47	51	30	25	64	61	61	48	52	51	72	4	68	1	1
Morocco	8	67	65	58	53	73	73	50	53	53	67	65	64	5	49	62	53	34	73	71	36	45	65	55	68	65	66	55	73	5	68	1	3
Thailand	32	27	47	18	76	59	54	30	73	48	39	53	51	8	22	36	41	18	16	64	38	41	60	35	49	38	45	41	76	8	68	1	1
Panama	38	31	23	25	39	37	47	35	69	61	37	39	36	2	24	39	31	6	33	40	13	26	52	25	34	18	24	33	69	2	67	1	1
Costa Rica	35	4	14	5	33	40	45	25	67	52	33	43	42	17	39	37	27	1	6	29	18	7	46	34	21	7	9	27	67	1	66	1	1
Israel	54	47	40	78	74	12	20	27	46	31	30	19	19	26	16	28	29	13	75	49	29	75	28	17	38	35	39	37	78	12	66	1	1
Korea (South)	55	34	74	70	70	10	25	21	19	19	22	21	16	10	14	19	19	47	45	36	31	70	21	8	22	23	21	31	74	8	66	1	1
Uruguay	61	36	3	49	7	33	36	34	57	32	28	38	35	49	52	12	21	64	20	8	69	33	35	28	23	19	19	33	69	3	66	1	1
Azerbaijan	22	71	62	42	68	52	42	65	31	59	57	46	46	55	30	44	70	56	56	69	7	54	39	45	52	72	67	51	72	7	65	1	1
Czech Republic	69	15	57	66	46	20	12	24	18	16	20	22	22	30	23	4	20	63	17	20	62	65	17	11	15	21	17	29	69	4	65	1	1
Hungary	42	35	36	51	47	25	23	26	2	17	24	25	27	58	41	34	28	67	34	28	3	44	18	33	18	41	30	32	67	2	65	1	1
Norway	66	3	2	46	25	1	1	3	4	1	1	1	1	24	9	3	1	25	5	2	20	32	1	3	3	2	2	11	66	1	65	8	1
Albania	25	12	20	9	13	41	40	59	36	30	61	48	50	42	62	67	68	15	12	48	5	4	38	59	25	46	37	36	68	4	64	1	1
Greece	64	26	45	64	49	22	24	15	26	22	21	18	21	79	64	74	37	58	71	23	48	63	22	58	44	49	48	43	79	15	64	1	1
Mexico	43	59	60	35	78	36	46	23	68	62	47	35	34	40	36	18	44	20	35	74	14	62	55	27	54	50	51	45	78	14	64	1	1
Moldova	11	69	39	52	44	63	49	75	43	46	58	72	71	15	61	32	61	32	54	62	45	40	51	56	57	62	60	51	75	11	64	1	1
Sri Lanka	6	43	51	6	3	56	48	31	66	40	59	62	61	14	47	47	42	29	10	30	6	2	58	50	30	27	27	35	66	2	64	1	1
Peru	14	58	12	29	2	47	51	40	62	64	49	49	47	41	42	27	52	22	38	14	1	8	53	42	28	31	29	35	64	1	63	1	1
Portugal	51	32	28	38	56	28	28	13	44	18	18	23	23	76	31	59	18	65	37	21	41	49	23	44	29	26	26	35	76	13	63	1	1
Ukraine	40	66	67	65	73	44	34	74	11	41	43	57	56	53	51	43	51	63	41	66	50	66	32	53	62	70	68	54	74	11	63	1	1
Georgia	20	37	38	17	34	43	41	66	52	56	41	61	62	73	55	70	69	43	48	44	19	15	43	72	51	58	54	48	78	16	62	1	1
Brazil	41	23	9	12	41	49	59	28	70	54	45	44	43	57	32	51	33	19	28	53	40	17	61	46	41	30	34	39	70	9	61	1	1
Egypt	16	46	71	63	27	65	67	61	35	34	60	58	59	64	72	53	77	62	65	52	27	39	48	63	60	75	71	55	77	16	61	1	1
Indonesia	7	54	49	16	11	68	64	53	39	60	64	67	67	31	33	52	46	12	32	50	25	10	59	57	40	36	40	42	68	7	61	1	1
United Kingdom	56	9	42	44	59	21	17	20	33	12	15	14	12	68	7	31	11	33	24	19	28	53	19	18	13	8	7	26	68	7	61	2	1
Ecuador	23	24	35	21	4	48	55	39	64	50	52	52	52	59	60	41	56	21	27	27	10	9	54	49	36	34	33	38	64	4	60	1	1
Lithuania	53	14	18	47	21	27	27	48	38	28	29	30	28	51	29	15	32	74	15	15	54	34	29	23	16	42	31	32	74	14	60	1	1
Paraguay	44	53	13	13	17	61	63	55	72	71	68	64	63	56	73	50	50	44	42	54	72	22	70	65	64	54	56	53	73	13	60	2	1
Austria	62	6	7	30	28	14	13	14	5	4	4	7	6	18	11	10	13	38	3	4	39	31	5	5	4	4	4	14	62	3	59	1	1
France	58	5	27	48	64	16	15	17	25	9	13	15	14	44	15	35	15	39	31	16	32	55	15	19	12	11	10	25	64	5	59	1	1
Switzerland	59	1	6	15	24	9	8	2	30	5	8	3	3	7	1	1	8	28	1	5	17	19	11	1	1	1	1	10	59	1	58	8	1
Chile	45	45	30	57	62	30	37	22	71	43	35	33	33	63	19	45	24	17	61	46	15	51	40	40	48	25	35	40	71	15	56	1	1
Slovinia	63	22	24	43	42	15	9	19	13	15	19	20	20	21	38	8	17	60	7	13	47	47	13	12	8	14	8	24	63	7	56	1	1
Germany	60	10	25	56	40	7	6	18	9	8	11	11	8	29	5	20	12	37	19	7	26	46	6	9	6	6	6	19	60	5	55	1	1
Jordan	29	74	54	77	69	55	50	56	48	42	63	59	58	65	45	77	57	24	79	75	34	67	50	71	74	69	73	59	79	24	55	1	1
Slovakia	47	11	33	45	35	24	18	33	6	14	27	24	24	11	50	11	26	61	9	24	21	37	20	14	7	22	16	25	61	6	55	1	1
Italy	57	7	44	39	60	19	19	6	21	20	14	16	18	48	26	23	23	40	13	17	35	52	14	22	11	15	14	26	60	6	54	1	1
Romania	37	60	59	37	63	34	30	44	28	36	38	34	39	12	54	21	43	54	25	55	9	50	31	26	32	52	43	39	63	9	54	1	1
Tunisia	24	64	37	61	52	54	58	63	49	35	51	51	54	19	25	38	58	31	60	61	12	48	47	41	50	59	55	47	64	12	52	1	1
Russian Federation	50	68	26	71	31	38	33	77	54	39	42	28	30	73	46	42	47	75	70	39	55	59	42	43	56	68	65	51	77	26	51	1	1
Macedonia	68	63	56	50	32	45	44	67	55	44	44	42	45	28	57	29	55	78	53	45	74	60	49	38	59	76	74	53	78	28	50	1	1
Bulgaria	48	41	46	54	58	35	31	43	58	27	31	36	38	50	43	33	36	76	41	43	51	56	34	39	43	61	53	45	76	27	49	1	1
Poland	49	19	53	55	61	26	26	36	34	21	23	29	25	36	27	13	22	52	22	34	44	57	26	21	24	24	25	33	64	16	48	1	1
South Africa	31	78	61	62	72	67	72	70	79	65	56	45	44	71	35	73	54	79	78	70	43	68	77	60	79	78	79	65	79	31	48	1	4
Turkey	36	70	58	60	66	53	52	38	50	47	48	37	37	67	28	24	65	36	57	65	22	61	44	36	53	64	62	49	70	22	48	1	1
Croatia	46	17	15	40	48	32	32	37	10	29	32	26	29	25	56	22	38	57	21	38	23	38	27	29	17	44	32	32	57	10	47	1	1
																										Average		40.0	72.7	7.4	65.4	27	27

Summary																													Total			
Highest Ranking	9	4	6	5	3	5	2	5	6	2	2	2	2	6	3	4	3	7	3	1	9	5	1	2	1	1	2	101			101	
Lowest Ranking	11	4	8	4	7	4	2	4	9	2	1	2	2	4	4	2	4	8	3	1	3	1	2	2	1	2	1	98				98
Contrast Total	20	8	14	9	10	9	4	9	15	4	3	4	4	10	7	6	7	15	6	2	12	6	3	4	2	3	3	199			199	
Contrast total ave/TBL3					12.2						7.3					6.2				7.5							3.0	7.4				
Contrast Ranking (Hi-Lo)	1	11	4	8	6	8	17	8	2	17	22	17	17	6	12	14	12	2	14	26	5	14	22	17	26	22	22					

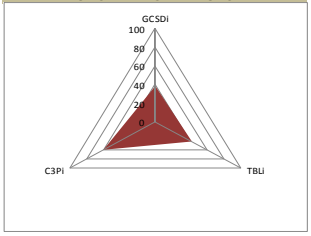
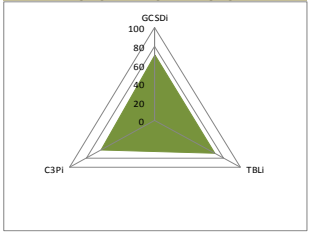
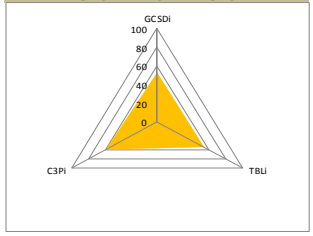
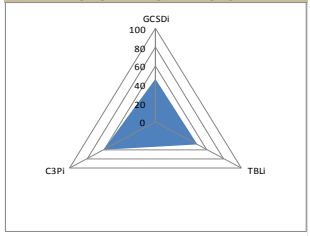
Appendix VII: How does South Africa perform?

Figure 35: How does South Africa perform?

DIFFERENT PERSPECTIVES OF TWENTY INDICES AND RESEARCH INDEXES

SOUTH AFRICA	BEST COUNTRY (SWITZERLAND)	MEAN COUNTRY (WORLD)	BRICS
ALL TWENTY-SEVEN INDICES	ALL TWENTY-SEVEN INDICES	ALL TWENTY-SEVEN INDICES	ALL TWENTY-SEVEN INDICES
			
TWENTY INDICES	TWENTY INDICES	TWENTY INDICES	TWENTY INDICES
			
SIXTEEN INDIVIDUAL INDICES	SIXTEEN INDIVIDUAL INDICES	SIXTEEN INDIVIDUAL INDICES	SIXTEEN INDIVIDUAL INDICES
			
FOUR COMPOSITE INDICES	FOUR COMPOSITE INDICES	FOUR COMPOSITE INDICES	FOUR COMPOSITE INDICES
			
TRILEMMA INDICES	TRILEMMA INDICES	TRILEMMA INDICES	TRILEMMA INDICES
			
SEVEN RESEARCH INDICES	SEVEN RESEARCH INDICES	SEVEN RESEARCH INDICES	SEVEN RESEARCH INDICES
			

SUMMARY OF SUSTAINABILITY INDEXES

SOUTH AFRICA	BEST COUNTRY (SWITZERLAND)	MEAN COUNTRY (WORLD)	BRICS
SINGLE INTEGRATED SDIs	SINGLE INTEGRATED SDIs	SINGLE INTEGRATED SDIs	SINGLE INTEGRATED SDIs
			

Appendix VIII: Twenty-six indices Characteristics

Table 24: Environment/Planet Dimension (5 indices)

	EF	Ecological Footprint
1.	Organisation:	Global Footprint Network (GFN).
2.	Attributes:	The EF measures and compares humanity's consumption against the Earth's regenerative capacity. Biocapacity is also measured in terms of the amount of biological productive land and sea area that is available to provide ecosystem services that humanity consumes.
3.	Purpose:	To track humanity's demands on the Earth's ecosystems.
4.	Unit of measure:	Global hectares (gha) per capita.
5.	Frequency:	The GFN releases National Footprint Accounts (NFA) annually.
6.	Indicators:	Refer Table 19 in Appendix II.
7.	Methodology:	The basic equations calculate the EF and biocapacity in terms of global hectares for different land use types into a single number. The calculation methodology and accounting framework is described by Borucke *et al.* (2013).
8.	Reference:	Column 1 in Table 18 in Appendix I.
9.	Source:	Ewing *et al*. (2010), Wackernagel and Rees (1996).

	EPI	Environmental Performance Index
1.	Organisation:	Yale University – Center for Environmental Law and Policy, and Columbia University – Center for International Earth Science Information Network.
2.	Attributes:	The EPI tracks outcome-oriented indicators in core policy categories. The EPI seeks to promote action through transparent and easily visualized metrics that enable political leaders to benchmark their nation's performance to other countries. The analysis focuses on two central environmental objectives: Reducing environmental stresses on human health; and promoting ecosystem vitality and sound natural resource management.
3.	Purpose:	Refer ESI.
4.	Unit of measure:	Scale 0 – 100.
5.	Frequency:	Following the ESI, the EPI 2012 is the seventh version.
6.	Indicators:	Refer Table 19 in Appendix II.
7.	Methodology:	Similar to the ESI methodology and including a materiality thresholds.
8.	Reference:	Column 2 in Table 18 in Appendix I
9.	Source:	Emerson *et al.* (2012)

	ESI	Environmental Sustainability Index
1.	Organisation:	Yale University – Center for Environmental Law and Policy, and Columbia University – Center for International Earth Science Information Network.
2.	Attributes:	The ESI was launched to complement the MDGs and be a counterpoint to GDP, which for too long had been the sole measure of wellbeing.The ESI is a measure of the overall progress towards environmental sustainability. It benchmarks the ability of nations to protect the environment over the forthcoming decades.
3.	Purpose:	To build on the well-established "Pressure-State-Response" environmental policy model and provide three outcomes: a powerful tool for putting environmental decision making on a solid analytical basis; offer an alternative to the GDP and HDI for monitoring a countries progress; and establish a useful instrument to benchmark environmental performance.
4.	Unit of measure:	Scale 0 – 100.
5.	Frequency:	2000, 2001, 2002 and 2005. Last used 2005, replaced by EPI.
6.	Indicators:	Refer Table 19 in Appendix II.
7.	Methodology:	Considerable conceptual and analytical processing is used to calculate the ESI. A six step approach is applied: Selection criteria for country inclusion; standardization of variables for cross-country comparisons; transformation of variables for aggregation procedures; algorithms used to substitute missing data, winsorization of data; and the aggregation of data to indicator scores and final ESI score.
8.	Reference:	Column 3 in Table 18 in Appendix I.
9.	Source:	Esty *et al.* (2005).

	EW (SSI)	Environmental Well-being (Sustainable Society Index)
1.	Organisation:	Sustainable Society Foundation.
2.	Attributes:	Refer SSI below.
3.	Purpose:	Refer SSI below.
4.	Unit of measure:	Refer SSI below.
5.	Frequency:	Every second year since 2006.
6.	Indicators:	Refer Table 19 in Appendix II.
7.	Methodology:	Refer SSI below.
8.	Reference:	Column 5 in Table 18 in Appendix I
9.	Source:	van de Kerk and Manual, 2012a

	EWI (WoN)	Ecosystem Wellbeing Index (Wellbeing of Nations)
1.	Organisation:	Robert Prescott-Allen with assistance from the World Conservation Union (IUCN) and the International Development Research Centre (IDRC).
2.	Attributes:	Refer WI below.
3.	Purpose:	Refer WI below.
4.	Unit of measure:	Refer WI below.
5.	Frequency:	Only produced in 2001.
6.	Indicators:	Refer Table 19 in Appendix II.
7.	Methodology:	Refer WI below.
8.	Reference:	Column 4 in Table 18 in Appendix I
9.	Source:	Prescott- Allen (2001)

Table 25: Social/People Dimension (6 indices)

	HDI	Human Development Index
1.	Organisation:	United Nations Development Programme.
2.	Attributes:	The HDI is “a composite index measuring average achievement in three basic dimensions of human development - a long and healthy life, knowledge and a decent standard of living”.
3.	Purpose:	To measure a countries level of development and progress over time.
4.	Unit of measure:	Scale 0 and 1.
5.	Frequency:	Annual - 21st report published in 2011.
6.	Indicators:	Refer Table 19 in Appendix II.
7.	Methodology:	The HDI is the geometric mean of normalized indices measuring achievements in each of the three dimensions. For income the natural logarithm of the actual minimum and maximum values is applied.
8.	Reference:	Column 6 in Table 18 in Appendix I.
9.	Source:	UNDP (2011).

	IHDI	Inequality-adjusted HDI
1.	Organisation:	United Nations Development Programme.
2.	Attributes:	The IHDI accounts for inequality in each of the three dimensions of the HDI – education, life expectancy and income per capita – by "discounting" the average value of each one according to its level of inequality. Countries with less human development tend to have greater inequality in more dimensions – and thus see larger losses in their HDI value.
3.	Purpose:	To measure of the average level of human development, of people in a society, after taking inequality into account.
4.	Unit of measure:	Value between 0 and 1.
5.	Frequency:	Annual since 2010.
6.	Indicators:	Refer Table 19 in Appendix II.
7.	Methodology:	Refer HDI.
8.	Reference:	Column 7 in Table 18 in Appendix I
9.	Source:	UNDP (2011)

	QLI	Quality of Life Index
1.	Organisation:	Economist Intelligence Unit.
2.	Attributes:	Uses nine quality-of-life factors to determine the QLI.
3.	Purpose:	To establish an index that explains the broader quality-of-life in a country, as opposed to GDP.
4.	Unit of measure:	Scale 0- 10.
5.	Frequency:	Once in 2005.
6.	Indicators:	Refer Table 19 in Appendix II.
7.	Methodology:	Multivariate framework. Links the results of subjective life-satisfaction surveys to the objective determinants of quality of life by country..
8.	Reference:	Column 8 in Table 18 in Appendix I
9.	Source:	Economist Intelligence Unit (2005)

	Gini	Income Gini coefficient
1.	Organisation:	Various.
2.	Attributes:	The Gini coefficient measures the inequality among values of a frequency distribution like income, where a Gini coefficient of zero represents perfect equality, and a Gini coefficient of one represents maximal inequality among values.
3.	Purpose:	To measure the inequality of income or wealth in a population or country.
4.	Unit of measure:	Scale 0 -100
5.	Frequency:	Recurrently.
6.	Indicators:	Refer Table 19 in Appendix II.
7.	Methodology:	Expressed as a ratio of the areas on the mathematically calculated Lorenz curve diagram.
8.	Reference:	Column 9 in Table 18 in Appendix I
9.	Source:	CIA (2012)

	HW (SSI)	Human Well-being (Sustainable Society Index)
1.	Organisation:	Sustainable Society Foundation.
2.	Attributes:	Refer SSI below.
3.	Purpose:	Refer SSI below.
4.	Unit of measure:	Refer SSI below.
5.	Frequency:	Refer SSI below.
6.	Indicators:	Refer Table 19 in Appendix II.
7.	Methodology:	Refer SSI below.
8.	Reference:	Column 10 in Table 18 in Appendix I
9.	Source:	van de Kerk and Manual, 2012a

	HWI (WoN)	Human Wellbeing Index (Wellbeing of Nations)
1.	Organisation:	Robert Prescott-Allen with assistance from the World Conservation Union (IUCN) and the International Development Research Centre (IDRC).
2.	Attributes:	Refer WI below.
3.	Purpose:	Refer WI below.
4.	Unit of measure:	Refer WI below.
5.	Frequency:	Refer WI below.
6.	Indicators:	Refer Table 19 in Appendix II.
7.	Methodology:	Refer WI below.
8.	Reference:	Column 11 in Table 18 in Appendix I
9.	Source:	Prescott-Allen (2001)

Table 26: Economic/Prosperity Dimension (5 indices)

	GDP	Gross Domestic Product (per capita)
1.	Organisation:	Various, like World Bank and International Monetary Fund.
2.	Attributes:	GDP is the main tool for measuring a countries economy It represents the market value of all goods and services produced by a country within a specified period of time, and is often used as an indicator of a country's standard of living.
3.	Purpose:	The GDP is a basic economic indicator that measures the level of economic output relative to a countries population.
4.	Unit of measure:	Monetary – $US.
5.	Frequency:	Normally annually.
6.	Indicators:	Refer Table 19 in Appendix II.
7.	Methodology:	GDP per capita is a function of dividing GDP at current market prices by the population.
8.	Reference:	Column 12 in Table 18 in Appendix I.
9.	Source:	World Bank (2011)

	GNI	Gross National Income (per capita)
1.	Organisation:	United Nation Development Programme (UNDP).
2.	Attributes:	Aggregate income of an economy generated by its production and ownership of factors of production, less the payments made for using factors of production owned by the rest of the world.
3.	Purpose:	Alternative measure to the GDP.
4.	Unit of measure:	Monetary, $US.
5.	Frequency:	Annual.
6.	Indicators:	Refer Table 19 in Appendix II.
7.	Methodology:	GDP adjusted for the attributes mentioned above.
8.	Reference:	Column 13 in Table 18 in Appendix I.
9.	Source:	UNDP (2011)

	ANS	Adjusted Net Savings
1.	Organisation:	World Bank.
2.	Attributes:	It is the rate of savings in an economy taking a number of factors into account: Investments in human capital, depletion of natural resources and damage caused by pollution. It is expressed as a percentage of GNI. A negative value indicates an unsustainable result.
3.	Purpose:	The ANS provides a measure of a country's sustainability.
4.	Unit of measure:	Percentage.
5.	Frequency:	Annual.
6.	Indicators:	Refer Table 19 in Appendix II.
7.	Methodology:	Percentage of GNI.
8.	Reference:	Column 14 in Table 18 in Appendix I.
9.	Source:	World Bank (2011). UNDP (2011)

	GCI	Global Competitiveness Index
1.	Organisation:	World Economic Forum.
2.	Attributes:	"It defines competitiveness as the set of institutions, policies, and factors that determine the level of productivity of a country. The level of productivity, in turn, sets the level of prosperity that can be earned by an economy. The productivity level also determines the rates of return obtained by investments in an economy, which in turn are the fundamental drivers of its growth rates. In other words, a more competitive economy is one that is likely to sustain growth".
3.	Purpose:	To measure the microeconomic and macroeconomic foundations of national competitiveness.
4.	Unit of measure:	Scale 1 – 7.
5.	Frequency:	Since 2005, the WEF has based its competitive analysis on the GCI.
6.	Indicators:	Refer Table 19 in Appendix II.
7.	Methodology:	Respondents answer a survey divided into 14 sections.
8.	Reference:	Column 15 in Table 18 in Appendix I.
9.	Source:	WEF (2012)

	EcW (SSI)	Economic Well-being (Sustainable Society Index)
1.	Organisation:	Sustainable Society Foundation.
2.	Attributes:	Refer SSI below.
3.	Purpose:	Refer SSI below.
4.	Unit of measure:	Refer SSI below.
5.	Frequency:	Refer SSI below.
6.	Indicators:	Refer Table 19 in Appendix II.
7.	Methodology:	Refer SSI below.
8.	Reference:	Column 16 in Table 18 in Appendix I.
9.	Source:	van de Kerk and Manual, 2012a

Table 27: Sustainable Development Composite Indices (4 indices)

	LPrI	Legatum Prosperity Index
1.	Organisation:	Legatum Institute.
2.	Attributes:	The index combines traditional economic measures of prosperity with measurements of wellbeing and life satisfaction. The institute believe that "it remains the only global index to provide an empirical basis for the intuitive sense that true prosperity is a complex blend of income and wellbeing".
3.	Purpose:	"The purpose of the Prosperity Index is to spark debate and to encourage policymakers, scholars, the media, and the interested public to take a holistic view of prosperity and to better understand how it is created".
4.	Unit of measure:	Scale 4 to -4.
5.	Frequency:	Annual since 2007.
6.	Indicators:	Refer Table 19 in Appendix II.
7.	Methodology:	The 89 variables are based on different units of measurement, from where they are transformed to a common scale using a statistical technique, standardisation. The standardised variables are compared and combined to form composite indices.
8.	Reference:	Column 17 in Table 18 in Appendix I.
9.	Source:	Legatum (2012)

	HPI	Happy Planet Index
1.	Organisation:	New Economics Foundation.
2.	Attributes:	The HPI is a measure of efficiency calculating the number of Happy Life Years achieved per unit of resource use. To provide a clear compass pointing nations in the right direction.
3.	Purpose:	To measure what matters most – sustainable well-being for all.
4.	Unit of measure:	Scale 0 – 100.
5.	Frequency:	Every third year. Introduced in 2006, second in 2009, and most recent 2012.
6.	Indicators:	Refer Table 19 in Appendix II.
7.	Methodology:	Similar to the HDI, uses natural logarithms and geometric mean.
8.	Reference:	Column 18 in Table 18 in Appendix I
9.	Source:	NEF (2012)

	SSI	Sustainable Society Index
1.	Organisation:	Sustainable Society Foundation.
2.	Attributes:	Covering sustainability comprehensively with specific focus on Human and Environmental Wellbeing. Economic Wellbeing is regarded as a safeguard to Wellbeing.
3.	Purpose:	To provide a tool to measure the level of sustainability of a country in absolute terms, this can then be compared to other countries.
4.	Unit of measure:	Scale 0 – 10.
5.	Frequency:	First conducted in 2006, conducted biennially, fourth edition in 2012.
6.	Indicators:	Refer Table 19 in Appendix II.
7.	Methodology:	Uses the mathematical function (x) to calculate an indicator score, where x is the value of the raw data. Aggregation by geometric mean.
8.	Reference:	Column 19 in Table 18 in Appendix I
9.	Source:	van de Kerk and Manual, 2012a

	WI	Wellbeing Index
1.	Organisation:	Robert Prescott-Allen with assistance from the World Conservation Union (IUCN) and the International Development Research Centre (IDRC).
2.	Attributes:	The Wellbeing Assessment is a method of assessing sustainability giving people and the ecosystem equal weight.
3.	Purpose:	It has a threefold intention: It intends to promote high levels of human and ecosystem wellbeing, demonstrate the Wellbeing Assessment tool, and encourage countries, communities and corporations to use the methodology.
4.	Unit of measure:	Scale 0 – 100.
5.	Frequency:	Once only in 2001.
6.	Indicators:	Refer Table 19 in Appendix II.
7.	Methodology:	Performance criteria are chosen for each indicator making them more operational and to enable measurements to be converted to a score so that they can be combined. Aggregation by arithmetic mean.
8.	Reference:	Column 20 in Table 18 in Appendix I.
9.	Source:	Prescott-Allen (2001).

Table 28: Complementary Indices (7 indices)

	ISEW	Index for Sustainable Economic Welfare
1.	Organisation:	Originally developed by Daly and Cobb (1994).
2.	Attributes:	The ISEW features a number of adjustments to GDP to account for social factors that affect welfare, environmental issues and the long-term sustainable use of natural resources. Enhancements to the ISEW have led to the replacement GPI.
3.	Purpose:	The intention is to replace the GDP as an economic indicator.
4.	Unit of measure:	Monetary.
5.	Frequency:	Besides the initial Daly and Cobb (1994) there have been no updates.
6.	Indicators:	Refer point 7.
7.	Methodology:	ISEW = personal consumption + public non-defensive expenditures - private defensive expenditures + capital formation + services from domestic labour - costs of environmental degradation - depreciation of natural capital.
8.	Source:	Daly and Cobb (1994). Posner and Costanza (2011).

	GPI	Genuine Progress Indicator
1.	Organisation:	Redefining Progress are the primary adopters of the methodology.
2.	Attributes:	An updated variant of the ISEW.
3.	Purpose:	To measure progress whilst achieving a sustainable economy.
4.	Unit of measure:	Monetary.
5.	Frequency:	Specific studies by certain countries and regions, for example see Päijät-Häme (2011).
6.	Indicators:	Refer point 7.
7.	Methodology:	The simplified formula is: GPI = A + B - C - D + I, where A) is income weighted private consumption; B) is value of non-market services generating welfare; C) is private defensive cost of natural deterioration; D) is cost of deterioration of nature and natural resources; and I) is increase in capital stock and balance of international trade.
8.	Source:	Talberth *et al.* (2006). Posner and Costanza (2011).

	GNHI	Gross National Happiness Index
1.	Organisation:	The Earth Institute.
2.	Attributes:	The report reflects a new worldwide demand for more attention to happiness and absence of misery as criteria for government policy. Happier countries tend to be wealthier but social factors are more important than income. Over the past 30years the world has only become marginally happier.
3.	Purpose:	To measure happiness.
4.	Unit of measure:	Scale 0 – 10.
5.	Frequency:	First report in 2012. Commissioned for the UN Conference on Happiness and mandated by the UN General Assembly.
6 & 7.	Indicators and Methodology:	The GNHI provides an overview of performances across nine domains (psychological wellbeing, time use, community vitality, cultural diversity, ecological resilience, living standard, health, education, good governance), and is aggregated out of 33 clustered indicators which are further composed of several variables. The 33 clustered indicators have 124 variables, which are the basic building blocks of the GNHI. Weights attached to variables differ and a threshold level is applied to each variable. At the domains level all nine domains are equally weighted as they are considered to be equally valid for happiness.
8.	Source:	Sachs *et al*. (2012).

	EneSI	Energy Sustainability Index
1.	Organisation:	World Energy Council (WEC).
2.	Attributes:	The WEC define energy sustainability in terms of three core dimensions - energy security, social equity, and environmental impact mitigation. The three goals constitute a 'trilemma', with complex linkages. Besides public and private players, governments and regulators, there are economic and social factors to consider alongside national resource and environmental concerns.
3.	Purpose:	To rank countries in terms of their ability to provide a secure, affordable, and environmentally-sensitive energy system. Energy performance indicators consider a number of factors - supply and demand, affordability and access to energy, and the environmental impact to a country due to energy use.
4.	Unit of measure:	Not given.
5.	Frequency:	4th edition of World Energy Trilemma Report published in 2012.
6.	Indicators:	22 indicators flow into an overall country score , made up as follows: • Indicator type: Energy performance – three dimensions (Energy security – 6 indicators, Social equity – 2 indicators, Environmental impact mitigation – 4 indicators). • Indicator type: Contextual performance – three dimensions (Political strength – 3 indicators, Societal strength – 4 indicators, Economic strength – 3 indicators).
7.	Methodology:	Indicator type Energy performance constitutes 75% of the overall country score, Contextual performance 25%. Each of the six dimension score are equally weighted within their respective axis (indicator type).
8.	Source:	World Energy Council (2012)

	YBLI	Your Better Life Index
1.	Organisation:	OECD Better Life Initiative.
2.	Attributes:	The framework identifies three pillars for understanding and measuring people's well-being: material living conditions; quality of life; and sustainability (Figure 14).
3.	Purpose:	To foster debate on well-being and engage citizens in the quest for progress, enabling citizens to compare wellbeing across 34 countries.
4.	Unit of measure:	Not stated.
5.	Frequency:	Pilot initiative.
6.	Indicators:	11 dimensions: Housing, Income, Jobs, Community, Education, Environment, Governance, Health, Life satisfaction, Safety, and Work-life balance.
7.	Methodology:	Cross-country correlations between different well-being indicators are established.
8.	Reference:	Figure 14 - Framework for OECD well-being indicators
9.	Source:	OECD (2011a)

	IWI	Inclusive Wealth Index
1.	Organisation:	United Nations University-International Human dimensions Programme (UNU-IHDP) and UNEP.
2.	Attributes:	"An index that measures the wealth of nations by looking into a country's capital assets, including manufactured, human and natural capital, and its corresponding values". To analyse "whether countries are on a sustainable path, and provide national governments with a metric to assess transitions towards the so-called "Green Economy"". "To become an indicator of progress towards Sustainable Development".
3.	Purpose:	"The primary objective of the Inclusive Wealth Index is to provide quantitative information and analysis that presents a long-term perspective on human well-being and measures of sustainability."
4.	Unit of measure:	Millions of constant US$ of year 2000.
5.	Frequency:	Pilot of 20 countries in 2012 the first of a biennial series.
6.	Indicators:	The IWI comprises three dimensions - Produced Capital, Human Capital, and Natural Capital – which include 26 indicators/elements.
7.	Methodology:	Wealth is assessed as the value of manufactured, human, and natural capital stocks, adjusted for population changes.
8.	Reference:	Figure 15 – The productive base and human well-being
9.	Source:	UNU-IHDP and UNEP (2012)

	LPI	Living Planet Index
1.	Organisation:	World Wide Fund.
2.	Attributes:	"The LPI reflects changes in the health of the planet's ecosystems by tracking trends in over 9,000 populations of vertebrate species. Much as a stock market index tracks the value of a set of shares over time as the sum of its daily change, the LPI first calculates the annual rate of change for each species' population in the dataset (example populations are shown in Figures 4-6). The index then calculates the average change across all populations for each year from 1970, when data collection began, to 2008".
3.	Purpose:	To measure the changing state of global biodiversity and determine trends over time.
4.	Unit of measure:	Staring with an index value of 1.0 in 1970 it measure percentage decline.
5.	Frequency:	Biennial.
6.	Indicators:	Based on 9,014 populations of 2,688 species of birds, mammals, amphibians, reptiles and fish.
7.	Methodology:	"All data used in constructing the index are time series of either population size, density, abundance or a proxy of abundance. The species' population data used to calculate the index are gathered from a variety of sources. The data must be collected using the same method on the same population throughout the time series and the data source referenced and traceable".
8.	Source:	WWF (2012).