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ASSESSING THE EFFICIENCY OF ECOLOGICAL FOOTPRINT AND GROSS DOMESTIC PRODUCT TOOLS IN THE PARADIGM OF SUSTAINABLE DEVELOPMENT IN THE 21ST CENTURY

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ABSTRACT.
The assertion that population growth and urban expansion affect environmental resources and human welfare is as old as written history itself; furthermore, the observation that rapid growth of the world economy is overtaxing the earth's natural resources due to extensive use of natural resources has received empirical backing from many quarters. One report after another has warned that unlimited growth of human population and resource-use is no longer sustainable. On the contrary, the economic tools and indicators measure economic growth without integrating environmental externalities that eventually outweigh the advantages of economic expansion and degrade the environment, thus relegating sustainability. Economists have always emphasized increase in possession without considering the adverse impact of natural resource abstraction. The emerging paradigm of sustainable development considers impact of economic investments on the environment to ascertain human wellbeing. Thus, there is growing recognition that traditional economic indicators such as Gross Domestic Product (GDP), Gross National Product (GNP), have become insufficient metrics for measurement of human well-being, because they fail to comprehensively integrate social well-being and environmental sustainability. Until a more suitable indicator that measures economic growth without sacrificing its impact on the environment evolves, the resource demand of economies and societies will continue to lopsidedly grow while the biosphere will also continue to be degraded. However, healthy productive ecosystems are the source of the materials and services that satisfy human needs. Managing the ecological asset becomes not only critical, but also challenging. The ecological footprint tool is an emerging tool that integrates environmental indices in measuring sustainable well-being and assesses both production and consumption patterns over time

without denying a decent standard of living in the world and to future generation. The paper assesses the efficiency of classical or traditional economic tools and the Genuine Progress Indicators (GPI) especially the ecological footprint with a view to ascertaining its advantages that will help nations to integrate the contemporary indicators to ascertain their true sustainable well-being status in the 21st century.

Keywords: *Comparative Assessment, Effectiveness, Ecological Footprint, Gross Domestic Product, Sustainable Development*

INTRODUCTION:

The philosophy of the GDP that 'more' is always 'better', has not only encouraged materialism, but has also made the population and the global economy to continuously grow, while our planet remains the same size and its finite resources continued to diminish, especially in the surrounding city-regions. The rapid growth of the world economy is straining the sustainable use of the earth's natural resources due to modern society's extensive use of natural resources to satisfy the urge for materialism. This growth has lead humanity into a state of global overshoot with demand for resources exceeding the earth's regenerative capacity (Rees,1996). However, as cities, nations and regions are increasingly accounting for the diverse economic, social, and environmental contributions to sustainable development and quality of life, they come to realization that their economic, social and healthy well-being depend on the natural resource vitality of the surrounding communities as well as knowledge. Measurement of development based on Gross Domestic Product (GDP) has always laid emphasis on economic parameters to the neglect of other parameters of social, environmental and natural resource relationship. It is therefore not surprising that it has imperceptibly led the world into a state of ecological overshoot, where the demand on nature exceeds supply, resulting in over harvesting of resources and accumulation of wastes. This is to say human-being are now living beyond the planet's ecological productive means. It also leads to the degradation of the natural assets that society depends on, which orchestrates grievous consequences on environmental and human well-being when resources are being used faster than nature can renew them. For example, this may initially be generating economic growth, but the consequence of depletion of natural resources will eventually outweigh the economic imperatives. This calls for more comprehensive indicators the will help nations to measure their true progress without leaving out environmental contribution and cost to development.

Problem issue

Cities, counties and states need indicators of their performance that can reveal about the larger ecological and social dimensions of human communities, and the sustainability of their activities. They need metrics that go beyond the standard economic indicators like Gross Domestic Product (GDP), but they also need indicators that can bring all of the disparate economic, environmental and social elements into a common framework and tell them whether they are making real, net progress.

The GDP has always and is still being used as a measure of society's welfare despite growing evidence that more wealth and economic output do not always improve the quality of life or the well-being of individuals or society. This implies that this traditional measure of progress, which is calculated by adding the economic value of goods and services produced in a nation, often fails to distinguish between economic "bads" that reduce society's well-being and "goods" that contribute to societal well-being and is based solely on economic output. In order to make progress toward improved human welfare, governments and organizations, economists and politicians including some of the original proponents of GDP accounting method, around the world began to search for more comprehensive indicators of environmental, social, and economic conditions when they noted that the GDP is a poor measure of economic well-being (Kahneman et al. 2004; Easterlin 2005a & b). Since the late 1960s, economists have also attempted to adjust GDP to measure society's well-being. Daly and Cobb (1989) developed the Index of Sustainable Economic Welfare, which was later revised as the Genuine Progress Indicator. The GPI starts with a measure of personal consumption; it integrates weighted income inequality, and adds or subtracts monetary value associated with various components that are expected to affect human well-being positively or negatively. Growth in capital and foreign borrowing, along with non-monetary contributions to welfare, such as household labour and volunteer work are added to GPI. Items included in the GPI include defensive private expenditures (e.g. pollution control), depletion of social networks such as cost of crime, family breakdown, lost leisure time; costs of environmental degradation, and depletion of natural capital.

The types of capital stocks considered in the computation of GPI according to Ekins (1992) include the following stocks:

(i) Built capital, the infrastructure including buildings, roads, factories, and machines that contribute to human economic production processes (ii) Human capital, the physical labor and knowledge that people bring to their work and

home lives; (iii) Social capital, the connections, institutions, rules, and norms that allow people to interact productively in all parts of their lives; and (iv) Natural capital, the land and natural resources that provide various ecosystem services needed for economic production, daily life, rest and relaxation.

These stocks do not only complement each other, but also provide important contributions to human wellbeing. The Genuine Progress Indicator (GPI) as trail-blazing measure of economic welfare that incorporates changes in environmental conditions, resource stocks, social capital, income distribution, and other non-marketed economic activity reveals the linkages of many challenges facing different continents especially the African continents to biological capital (Cohen,1995). These challenges manifest in the form of rapid demographic growth, food insecurity and persistent malnutrition, violence or conflict, political instability, human rights abuses and inequitable access to natural resources, which financial indicators such as GDP alone is necessary, but insufficient to solve. Ecological footprint also measures the genuine progress as it integrates social, ecological and economic wellbeing. However, as comprehensive as ecological footprint tool proves to be, many nations are yet to understand, accept and apply it in computation of natural capital to ascertain the true development and societal welfare (Global footprint network, 2011).

Suffice to say that interactive mechanisms and feedback between the human society and the planetary resources are not immediate. For example, the resource demand of economies and societies may continue to grow while the biosphere is degraded, which makes humanity to continue depleting the planet's ecological assets to advance human well-being. However, it has become evidently clear that healthy, productive ecosystems are the source of the materials and services that satisfy human needs. Therefore, managing biological assets becomes not only more critical, but also more challenging as one draws the issue of ecological footprint to bear on economic, environmental and human well-being. This dimension, in particular, makes many earlier methods for measurement of economic and human well-being including the popular GDP to be insufficient to capture this variable. The advent of Ecological Footprint (EF) as a measuring tool has brought solution to the long-time search for a robust tool that is not bias to economic, but that incorporates economy, ecology and environmental integrity in the measurement of human development and satisfaction.

However, the plaguing questions begging for answer which this paper attempts to answer are (i)how has the methodical search been carried out? (ii) What is ecological footprint tool? (iii) How is it more efficient than GDP? (iv) How can nations understand and apply it?

Objectives: While this paper aims at assessing the efficiency of ecological footprint and GDP tools, its objectives that will guide data collection are (i) to appraise the trend of methodical search for efficient tool that can measure economic development that include human and environmental wellbeing. (ii) To explain the contextual meaning of ecological footprint as a concept and as a tool. (iii) to explain the efficiency of ecological footprint tool in the measurement of economic wellbeing that incorporates environmental variable (iii) to shade light on its understanding and application to regions and nations.

Methodological search

This paper uses secondary data as it adopts previous literature content review to assemble data and also uses literature content analysis to analyse previous methods used to ascertain improvements in economic, environmental and social wellbeing as the tripartite pillars of sustainability. One problem that societies wishing to improve their economic, ecological and social performance have been facing is the lack of reliable methods of measuring to manage and monitor their ecological performance. Over the years, a wide range of methods and approaches have been employed to quantify the capacity of nature to regenerate resources and produce life-support services for the living species. In the review of the earlier attempts, Cohen (1995) affirms that much intellectual ground work was laid in the last three decades of the 20th century. For example, Howard Odum's energy analysis examined systems through embodied energy flows (Odum, 1994); Jay Forrester's attempt on modeling the world resource dynamics (Meadow et al 1972); John Hodren's and Paul Ehrlich's I=PAT equation (Ehrlich and Hodren, 1974) or in the context of the International Biological Programme, Robbert Whittaker's calculation of Net Primary Productivity of the world's Ecosystem (Whittaker, Lieth and Whittaker, 1975). The last two decades have witnessed exciting new developments; life cycle assessment (Abel *et al,* 1990); Lifestyle energy assessment (Hofstetter, 1991); Environmental space calculations building on the ideas of Joham Opshoor (Buitenkamp*et al*, 1992); Human appropriation of net primary productivity (Vitousek*et al* ,1986); Documentation of regional and industrial metabolisms (Ayres *et al*, 1994); Mass intensity measure such as mass intensity per unit of Service (MIPS) (Schimidt-Bleek,1994). Measures of human process such as sustainable process index SPI (krotschek and Narodoslaawsky, 1995;1996); National resource inventories (as performed by Norwegians and the French); Resource accounting Input-Output models (Dutchin and Lange, 1994); Computer based gradient models for analyzing land use development and ecological potentials (Hall, 1996); the

polstar scenario model (Galloping *et al*, 1997, 2003). In line with this trend, the insufficiency of most of these methodical searches including the GDP for the measurement of true development became evident. Nordhaus and Tobin (1972) concluded that from the early 1970s, economic growth was leading to improvements in quality of life in the United States. Daly and Cobb (1989) revisited Nordhaus and Tobin's findings with their Index of Sustainable Economic Welfare (ISEW), which was later revised as the Genuine Progress Indicator (GPI). The GPI begins with a measure of personal consumption, weighted to account for income inequality, and deducts or adds value for various monetized measures of built, human, social, and natural capital. This is expressed in the form of the equation (adapted from Hanley et al. 1999):

GPI = Cadj + G + W – D – S – E – N

Where: Cadj = personal consumption adjusted to account for income distribution, G = growth in capital and net change in international position, W = non-monetary contributions to welfare (e.g., household labor, volunteer work), D = defensive private expenditures, S = depletion of social capital (e.g., cost of crime, family breakdown, lost leisure time), E = costs of environmental degradation, and N = depletion of natural capital.

The inclusion of these components makes GPI better suited than GDP to address the questions of distribution, societal well-being, and sustainability within the economy. Daly and Cobb and other authors found that GPI grew, though not as quickly as GDP, until the mid-1970s, and has since leveled off or declined slightly. These results agreed with Max-Neef's (1995) "threshold hypothesis," which states that economic growth improves quality of life up to a point, but eventually erodes environmental and social quality, thereby reducing the quality of life. Cohen (1995) observe that attempts to compute ecological footprint as a measure of sustainable development have produced a variety of approaches**,** such as (i) summation of agriculture productivity in various regions of the earth to obtain total productive area and land capability; (ii) determination of human carrying capacity (the number of people that can be supported by a given area of the earth's surface) among others. Ecological footprint method builds on a wide range of earlier methods to assess the capacity of nature to regenerate resources and produce rich life-support services.

The issue of 'how much' consumption in sustainable also needs to be addressed and to quantify resource targets. Ecological Footprint Analysis (EFA) tool approaches the issue of sustainability by referencing to the overall 'carrying capacity' and relating it to the resource supply of the planet and human demand. The ecological footprint has also integrated the production and consumption

sides to reveal the impact, unlike sustainability that focuses the supply side. Thus, it is able to link individual behaviour to wider institutional targets, using concepts such as the 'earthshare' - the average sustainable bio-productive capacity available per person. Therefore, ecological footprint as one of the approaches inverts the carrying capacity process. Instead of asking how many people can live in an area, it estimates area of the earth's surface required to support a given human population.

The computation of the 2010 edition of the National Footprint Accounts provides researchers and practitioners with information to deepen their understanding of the methodology for the Ecological Footprint. It also includes calculation of bio-capacity, yield factors, equivalence factors, and the specific land use types such as cropland, grazing land, fishing ground, forest land, carbon uptake land, and built-up land that are included in the ecological footprint method. Unfortunately, the dearth of data and its characteristic flexibility on biological capital in developing countries, especially Africa, is daunting.

From the above discussion, it can be seen that many of the challenges facing the African continent are linked to biological capital. These include rapid demographic growth, food security and persistent malnutrition, violent conflict, political instability, human rights abuses, and inequitable access to resources.

In today's world, where humanity is already exceeding planetary limits, ecological assets are becoming more critical with different countries having their ecological risk profiles and some are on ecological deficits (where their footprints are larger than their biological capacity). Others depend heavily on resources from elsewhere, which are under increasing pressure. The implications of ecological deficits in some countries can be devastating, leading to resource loss, ecosystem collapse, debt, poverty, famine and war (Rees, 2006). Having realized that the ecological footprint is a resource accounting tool that helps countries understand their ecological balance sheet and gives them the data necessary to manage their resources and secure their future, some developed countries have not only accepted it as a more realistic tool, but initiated reviews of assessing their progress using ecological footprints (Rees, 2002). They include Switzerland, Japan, Germany, U.K, European Commission and the United Arab Emirate.

Comparative analysis

This paper compares GDP and ecological footprint to deduce the operational advantage of one over the other. In terms of variables that nurture growth, the GDP does not consider how growth is being nurtured and it does not consider

other social and environmental parameters such as crime, sickness, pollution, accidents and natural disasters that may make the economy to grow. Besides, the GDP ignores anything that does not have a price tag – like volunteer work, unpaid household work, free time, and vital life-supporting services freely provided by nature; as such the GDP can grow even when inequality and poverty grow. Concisely, the GDP and related economic growth statistics are incapable of telling us how "well off" we are, let alone whether our development is sustainable. Furthermore, the architects of the GDP never intended to use it as a measure of well-being and progress the way it is used today. Thus, Rees and Wackernagel (1996) posit that economists leave out of their growth measuring mechanisms issues of social and environmental sustainability. This leads to the concern for and development of Ecological Footprint, which by contrast, attempts to account for our social, environmental *and* economic health. The 22 GPI components include natural resource accounts, time use variables (including the value of unpaid work and free time), and indicators of health, educational attainment, livelihood security, equity and environmental quality. It also counts liabilities like crime, pollution, greenhouse gas emissions, sickness and accidents as *costs*, rather than gains to the economy.

Unlike the GDP that measures only current income and spending regardless of its consequences, the ecological footprint assesses whether we are leaving the world a better place for our children as well as ourselves. Thus, it is called an index of *sustainable* development because it assesses whether current production and consumption patterns can be *sustained* over time without depleting our stock (our natural, social and produced capital) and without denying a decent standard of living to our children and to people in the other parts of the world.

In Rees (2008), the e*cological footprint* analysis is a complement of the Genuine Progress Index, for four basic functions: (1) It assesses the *demand* side of the sustainable development equation as well as the supply side, and places the onus for sustainability on the *consumer* as well as on the producer; (ii)It challenges fundamentally the economic growth paradigm and the assumption that "more" is necessarily "better." In the ecological footprint index, a *smaller* footprint is a sign of genuine progress.

(iii) It links environmental sustainability clearly and directly with social justice and equity; and (iv) It links local consumption patterns with global consequences.

In terms of sustainability measurement, further comparison corroborated that most measures of sustainable development implicitly place the onus of change on the producer and exonerate the consumer. Natural resource accounts, for

example, assess whether timber, fish, agricultural products and other resources are being harvested sustainably, and they may recommend more sustainable harvesting methods (e.g. selection logging, restrictions on dragnet trawling, and shifts to organic farming) which require changes in production techniques. But ecological footprint method places the onus for sustainability directly on the shoulders of the consumer. Because it addresses the *demand* side of the sustainability equation as it increases supply; and also assesses the environmental impacts of our *consumption* patterns, the ecological footprint remains an essential complement to other GPI components that focus on the *supply* side of sustainable development.

2) Conventional measures of progress based on the GDP and related economic growth statistics implicitly assume that "more" is "better." The more there are economic activities, and the more money people spend, the "healthier" and more "robust" our economy is said to be, and the "better off" we are assumed to be. When sales go up, economic experts and journalists pronounce that "consumer confidence is strong." When sales go down, that confidence is said to be "weak," and the slowdown spells trouble. The language we use daily reflects the implicit assumption that "growth" equates to "health" and "well-being."

The ecological footprint index challenges the core assumption directly, and contains several components in which "less" is frequently "better," and a more accurate signal of societal well-being. As noted above, more crime, more pollution, more sickness and accidents, more greenhouse gas emissions and natural disasters all make the economy grow simply because more money is being spent on prisons, police, hospitals, pollution cleanup and other regrettable expenditures. The prison industry is one of the fastest growing sectors of the US economy contributing $42 billion a year to the US GDP. Smoking and obesity contribute $300 million a year to the Nova Scotia economy in medical costs alone (Global footprint network, 2011). By contrast, *less* crime, pollution, sickness, accidents and greenhouse gas emissions are signs of genuine progress and well-being. This is common-sense economics, but it challenges our current reliance on economic growth statistics to assess societal well-being.

The *Ecological Footprint* analysis clearly illustrates this point that "less" is sometimes "better." A sustainable ecological footprint, which is significantly *smaller* than the current ecological footprint of Nova Scotians and Canadians, is a sign of genuine progress because it indicates that we are having *less* impact on the environment and preserving the health of our natural wealth more successfully for the benefit of future generations. The large current footprint of Nova Scotians and Canadians indicates quite simply that we are living beyond our

means, and that the Earth cannot indefinitely sustain our current consumption habits. Scientists have noted that the natural world thrives on equilibrium and balance, and rests firmly on inherent *limits* to growth. The only biological organisms that thrive on unlimited growth, like cancer cells and weeds, are inherently destructive. This is an apt metaphor and warning for a human economic paradigm that remains wedded to a doctrine of limitless growth.

3) The basic principle linking and integrating the components of new measures of progress and well-being is the view of "sustainable development," which reflects a concern (a) to live within the limits of the world's and the community's resources and (b) to ensure the long-term prosperity and well-being of present and future generations. Unlike measures of well-being based on economic growth, which implicitly assume that a rising tide lifts all boats, sustainable development measures acknowledge that there is no such thing as an indefinitely rising tide and that the metaphor seriously distorts nature's processes. Measures based on recognition of *limited* resources therefore acknowledge that societal well-being is a *distributional* issue and that poverty will not be solved simply by producing *more* goods and services.

4) Finally, most components of the Genuine Progress Index, including the natural resource accounts, assess local impacts of local practices. The reality of an interdependent world and a global economy is that local behaviour and distant events have global impacts. A particular contribution of the *Ecological Footprint* analysis is its recognition that local consumption practices may involve natural resource depletion from far away. Wackernagel and Rees (1996) posit that we may indulge in an unsustainable consumption in North America, without depleting local resources, but rather by "appropriating the carrying capacity" of other distant countries through trade. Therefore it is right posit that the impact of ecological footprint of a nation may exceed the national boundaries of such nations to other countries.

The ecological footprint tool developed by researchers at the University of British Columbia enables us to measure progress towards sustainability by measuring the impact of human activities on the environment according to how much land it takes to produce the resources necessary to sustain those activities. The smaller our ecological footprint, the less we are depleting the earth's limited resources and degrading the natural environment, and the healthier the natural legacy and wealth we leave to our children. The ecological footprint concept is based on the simple maxim that all human activities depend on nature as the basis of all life-support functions. Nature provides the air we breathe, our food and water, the energy we need for heat, light, transportation, and operation of

our machines, as well as the materials we use to build our houses and to make our clothes, computers, cars, paper products and every other object that cycles through the economy. Nature also acts as the dump for our waste products. For example, the carbon dioxide, acid gases, and particulate matter that our cars emit, the phosphates from our detergents and fertilizers, the synthetic chemicals found in plastics, paints and other artificial products, and the garbage we put out on the curb each week all end up in our environment. Therefore, human beings have an impact on the earth simply because they consume nature's products and services. Our personal ecological footprint, therefore, corresponds to the *amount* of nature we use or occupy in order to live. This need not be of concern as long as the human load remains within nature's "carrying capacity" (the ability of the natural world to support human activity and renew itself without depleting natural resource stocks). The sustainability challenge, therefore, is to attain a high quality of life for the residents of any study area, while ensuring that our resource consumption and waste generation remain within the carrying capacity of nature. If we divide all the biologically productive land and sea on this planet by the human population in the year 2000, there is an average of 2.1 hectares of biologically productive land and sea per person. If we set aside 12% of the ecologically productive land for biodiversity preservation, as recommended by the Brundtland Commission, the available bio-productive space per person shrinks from 2.1 hectares to just under 1.8 hectares.

Since we share the planet with over 10 million other species, it is clearly not possible to use the entire bio-productive ecological space of the planet solely for human consumption. Indeed, it is doubtful that the human species itself would survive if it used all productive resources for its own needs at the expense of all other species. Conservative biologists recommend a minimum of 30% of bio-capacity to set aside for biodiversity preservation. However, only 12% is recommended by the Brundtland Commission and set aside to minimize the ecological scarcity seen by scientists. Indeed, the 12% target is what is deemed *politically* feasible based on international agreements. The actual biodiversity preservation required for the longer term self-preservation of the human species and to slow the current extreme rate of species extinction will likely require *greater* land protection.

The sustainability challenge will not become any easier with a projected population of 10 billion people within the next 30 to 40 years (global footprint network, 2011). At that time, the available space will be reduced to 1.2 ha. per person worldwide. It must also be emphasized that this projection has not factored in the probable loss of biologically productive space due to

unsustainable harvesting methods, clear-cutting, soil erosion, and the expansion of the built environment, nor does it include the impact of most waste products. Given these highly conservative assumptions and exclusions, the 12 bio-capacity reserve can be considered a very generous estimate.

Ecological time trends and its integration in the GPI

Since the early 1970s, one report after another have warned that unlimited growth of human population and consumption has become unsustainable. The most prominent of such reports are *TheLimit to Growth* (Meadows et al 1972), the Brundtland Commission's Our Common Future (WCED, 1987), the World Watch Institute's Annual State of the World Publications and the Millennium Environmental Assessment (2005). Despite these warnings, humanity has continued to celebrate economic expansion, with more people, more consumption, more waste and more poverty, along with less biodiversity, less available fresh water, less fossil oil in the ground and less productive ozone in the atmosphere (World Resource Institute, 1994, 1996).

There are ready evidences to show that there has been growth of the world economy through the intensive and extensive use of environmental resources. There is growing recognition that the existing economic indicators such as GDP are insufficient as metrics of human well-being and development. The rapid growth of the world economy is highly resource-demanding thereby straining the sustainable use of the earth's natural resources for metals, materials and products. The current emphasis on sustainable development is due to the general awareness of the need to solve numerous environmental problems resulting from our modern societal economic demands, which has signaled the need to assess the impact of economic investments on the environment. The topic of economic investment assessment versus environmental economics needs to be discussed in an integrated way, in accordance with the principles of sustainability that considers the social and environmental aspects of new investments, as well as possible environmental damage. The roots of financial development are financial growth, which in conventional terms, requires an increase in production and the use of more resources. However, the unsustainable abstraction and overuse of natural resources can result in the destruction of natural resources and larger releases of waste and pollution into the environment; it also exerts adverse effects on ecosystems as well as increase their impact on the environment. Thus, it is necessary to understand the economic impact of toxic products on the environment, which may cause economic growth.

Bio-capacity and Ecological Footprints are measured in global hectares. A global hectare is an area-normalized unit of productivity, equal to the annual productivity of one hectare of biologically productive land or sea with world-average productivity. Use of global hectares as a productivity measure allows world-wide comparisons of bio-capacity and demand, while recognizing large differences in ecosystem productivities. Within the context of global overshoot, different regions show different levels of consumption and ecosystem capacity. This demand on biological capital can be measured with the Ecological Footprint tool.

The Implication of Excess Human Footprint on Sustainable Capacity of the Earth

The current global ecological footprint is 2.8 ha. per person. With an available space of just 1.8 ha/per person, (that is a shortage of 1.0 gha). This affirms that humanity already exceeds the sustainable capacity of the earth. In other words humanity is consuming more than nature can regenerate.

The occurrence of ecological overshoot is enhanced when (i) human demand in an area exceeds the regenerative capacity of its collective natural ecosystem or when humanity demands more resources and produces more waste, such as CO2, than the biosphere can regenerate and re-absorb (ii)the amount of productive land and sea area is unable to cope with what it takes to produce all the resources a population consumes and absorb its waste, using prevailing technology (iii) humanity begins to use more ecological resources and services in a given year than the earth can regenerate in that year. This overuse adds to our global ecological debt – the slow depletion of resource stocks and accumulation of waste, primarily CO2 in the atmosphere (iv) Global hectares (acres) are exceeding the world-average bio-productivity.

Global "overshoot" is being widened through (i) depleting reserves of natural capital (oil, natural gas, old growth forests); (ii) over-harvesting renewable resources to the brink of collapse (the Atlantic cod fisheries); (iii) causing irreversible ecological damage (species extinction, desertification); and (iv) overloading our environment with waste products (causing air and water pollution, climate change, stratospheric ozone depletion, and toxic chemical build up).

Never before have there been 7 billion people on planet earth, all at the same time. For the first time, we welcomed the 7 billion global inhabitants in 2011, we have acknowledged the consequent challenges we have been facing due to a burgeoning population explosion, resource depletion, food and water scarcity and overcrowded cities Global footprintnetwork, 2011). This is especially true at

a time when humanity as a whole is already using the planet's regenerative capacity faster than it can renew. Besides, there is uneven resource distribution among the 7 billion people. A large portion of humanity does not have enough resources to secure even their most basic subsistence needs. The revelation of how much nature we have, how much we use, and who uses what helps decision makers understand our present resource situation and find options to avoid unpleasant consequences in the era of ecological footprint tool.

The Concept of Ecological Creditor/Debtor

The concept of Ecological Creditor and Debtor aims at showing the interdependence between a country's bio-capacity, its economy and the welfare of its people. As resource pressures escalate, ecological wealth will play an increasing role in determining such countries' competitive position, its citizens' ability to live secured and rewarding lives.

The concept also shows that in a globalized economy, trade is an indispensable activity of life that services the economy and it considers the demand on nature, and bio-capacity of countries, territories, and regions. This has economic implications, particularly for developing countries that depend on large amount of ecological assets to power their key industries or to support their consumption pattern and lifestyle. On the other hand, countries with natural resources of valuable asset may be at a secured economy and position.

However, in a globalized economy, trade is a necessity involving material resources for which money is paid. Such resources may be scarce at particular seasons and places leading to importation from other places of abundance for consumption or trade. The concept of ecological creditors and debtors does not imply that by comparing a population's consumption with its own bio-capacity, a country's consumption would be limited within its borders and not engage in global trade. But just as a trade deficit can be a liability, so can a bio-capacity deficit – in particular, or because of that deficit, a country finds itself at risk of depleting its own natural capital, incurring higher costs for importing resources from elsewhere, or facing costs for emitting carbon dioxide into the global commons. This concept seeks to enable countries to see the benefit in reducing their resource dependence on the one hand, and increasing or maintaining ecological reserves on the other.

Conclusion:

The research conducts a comparative review of the ecological footprint and the classical GDP; from literature content analysis it finds that the ecological

footprint analysis tool is a more robust and efficient tool for measuring sustainability of the economy, environmental resources and human wellbeing than the GDP.

The study also shows that while the average world inhabitant Ecological Footprint is 2.2 global hectares, the African average is at 1.1 global hectares per capita. In comparison, Africa's bio-capacity is 1.3 global hectares per person, slightly more than what Africans use. Yet, Africa's bio-capacity is 28 percent lower than the world-average of 1.8 global hectares per person.

The study reveals that humanity's use of nature, in terms of natural resources and services, has increased from using slightly more than half of planet Earth's bio-capacity in 1961 to the equivalent of 1.4 planet Earths in 2009. This implies by projection that humanity is requiring the equivalent resources of two planets by the early 2030s, (Global Footprint Network and WWF's *Living Planet Report 2008*). This would put the Earth Overshoot Day on July 1, and that means it would take two years for the planet to regenerate what we use in one year, except remedial actions are taken.

In 2005, data available showed that the biologically productive area available on this planet was 2.1 hectares/person (5.2 acres), with no area set aside for wild species. Meanwhile, the average per capita Ecological Footprint was 2.7 global hectares/person, which implies (6.8 acres); the global hectare /person of the United States is 9.4 global hectares (24 acres). If everyone in the world consumed resources like an American, it would take the resources of almost five planets to sustainably support humanity.

Recommendations:

The need to preserve the health of national economies is inevitable, but the ecological drivers of our economic crises go unnoticed. The world is suffering the consequences of ecological overshoot, which can be changed by demonstrating to national government that they can be more economically competitive in the 21st century if they function within their ecological limits. It is negligence that leads to implications such as the drought and famine destroying countless lives in the horn of Africa, the massive social uprising of the Arab Spring, and the unprecedented financial crises that have reached every nook and cranny of the globe. In this view, economists need to accept this bitter truth the GDP proves insufficient in measuring human welfare and not only embrace but also popularize the use of ecological footprint tool. Planners are required to perfect this tool to help political leaders to know and manage their bio-capacity and ecological overshoots. The challenge is that no matter what the leaders know

about ecological limits, they all consider their first priority to be the prosperity of their country. Most world leaders ironically believe that to sustainably manage their resources will weaken their economy. Consequently, there is need to exhibit rigorous research to build a solid case to link resource constraints to economic performance, which will convince leaders to sustainably manage their resources in their direct economic interest. This is because to continue the destructive economic policies will lead us to worsening ecological imbalance, but if we make substantial changes that will push us back into ecological balance and on a path towards sustainable prosperity, it will be the hope of mother earth in this 21st century. The paper submits to the improvement and dissemination of knowledge on methods, policies and technologies for increasing the sustainability of development by de-coupling growth from natural resources and taking into account its economic, environmental and social pillars, as well as methods for assessing and measuring sustainability of development that prioritizes human welfare. The paper further substantiates and articulates the case for financial institutions and ratings agencies to include ecological criteria as a key component of financially material country credit risk analysis. This will help institutions to work towards a nexus for environmental, social and governance (ESG) issues in financial products and services.

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