

ECONOMIC GROWTH IN THE CONTEXT OF SUSTAINABLE DEVELOPMENT

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The book titled *The Limits to Growth*, written in 1972 by Meadows, Meadows, and Randers, precipitated the idea of sustainable development. The authors were tasked by the global think tank, Club of Rome, to develop a simulation testing the effects of a growing world population on a fixed resource base. The results of the simulation was sobering, the world had less than 100 years before experiencing catastrophic decline in population and industrial capacity. Economists were critical of the results, especially since the researchers were not economists and the simulation did not include prices, the primary signaling mechanism for consumer behavior. (Cleveland & Ruth, 1997) (Georgescu-Roegen N. , 1975) Nevertheless, this shot across earth's bows caused the public great concern and as a result many economists, ecologists, political scientists and started thinking about optimal growth paths and how to provide for the growing human population in a world that had a fixed amount of resources. Sustainability and sustainable development research is a result of this inquiry, with many theories and thoughts about how best to deal with scarcity, overpopulation and environmental degradation. (Bander, 2007)

Finding a definition for sustainable development is not difficult. John Lezzy, in a 1992 World Bank Report, was able to provide over thirty different definitions that he found in the peer reviewed academic journals. (Pezzy, 1992) The published definitions have some commonality, especially in the areas of environmental concerns over scarcity of resources and degradation of the ecosystem, the plights of the world's poor and a social responsibility to future generations. However, there exist enough differences in the definitions to hamper effective analysis and actualization of the concepts of sustainable development. Even among the evangelists of sustainable development, the contentions over what it means to be sustainable and what constitutes development are fierce. One hotly contested part of the debate is the significance of economic growth in sustainable development.

The intent of this paper is to explore theories of economic growth in the context of sustainable development, beginning with the most agreed upon definition of sustainable development, published in the 1987 Brundtland Commission Report. By examining the commission's thoughts on sustainable development and economic growth and then reviewing

responses and other theories of economic growth in the economic literature, a clearer understanding of the impacts of economic growth in a sustainable development context is presented. A taxonomy of the possibilities is simple to create and has only three possible categorizations, 1) *there must be continued economic growth*, 2) *there cannot be economic growth beyond a certain limit* and 3) *economic growth must decline as limits have already been exceeded*.

This paper does not attempt at proposing or advocating for an optimal or even a correct solution, that is the responsibility of the reader. It would also be an exhaustive exercise to include all the literature on the range of possible solutions. This paper focuses on one major approach in each categorization of economic growth in sustainable development. The first approach, *there must be growth*, is articulated in the Brundtland Commission report and the neoclassic approach to sustainable development found primarily in the writings of Robert Solow. Herman Daly's steady state economy forms the basis for the second, *there cannot be economic growth* argument and the French economic de-growth movement as characterized in the writings of Joan Martinez-Alier and Serge Latouche as the third, *economic growth must decline*, approach. The works of Nicholas Georgescu-Roegen on entropy and economics is also included since he was a very influential contributor to both the steady state and degrowth economic approaches. The analysis is not limited to these researchers, but these names have become synonymous with the three possible approaches to economic growth in sustainable development and their thoughts are given greater attention.

ECONOMIC GROWTH AND THE BRUNDTLAND REPORT

In 1983, the World Commission on Environment and Development, WCED, was tasked by the General Assembly of the United Nations with producing 'a *global agenda for change*'. Of concern was the effects of varying levels of economic and social development among nations on the environment and how to develop cooperation between countries that are at differing levels of development "*in achieving sustainable development by the year 2000 and beyond*." (World Commission on Environment and Development, 1987, p. ix) It is clear from this mandate that sustainable development was considered a new process and not an "end goal."

The WCED published its findings in 1987 in a report titled ***Our Common Future***. It is more commonly known as the Brundtland Commission Report, named after the chairperson of the WCED, Gro Harlem Brundtland. In the Chairman's foreword of the report, Brundtland makes comments

that provide guidance when interpreting the intent of the various portions of the resulting report. The strongest commentary is on the connection between poverty and environmental degradation;

Environmental degradation, first seem as mainly a problem of the rich nations and a side effect of industrial wealth, has become a survival issue for developing nations. It is part of the downward spiral of linked ecological and economic decline in which many of the poorest nations are trapped. (World Commission on Environment and Development, 1987, p. xi)

The downward spiral of poverty and environmental degradation is a waste of opportunities and of resources. In particular, it is a waste of human resources. These links between poverty, inequality, and environmental degradation formed a major theme in our analysis and recommendations. What is need now is a new era of economic growth – growth that is forceful and at the same socially and environmental sustainable. (World Commission on Environment and Development, 1987, p. xii)

The last line of these comments lays the groundwork for the Brundtland definition of sustainable development and provides the reader some insight on the reports stand on economic growth.

The definition for sustainable development, given in the Brundtland report is the most widely held definition and most researchers and practitioners will cite the following definition.

Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. (World Commission on Environment and Development, 1987, p. 43)

That citation is only the first sentence of the definition but many are content to use just that one sentence. To do so means missing the mark. The sustainable development definition in the report is actually three paragraphs in length and requires another 22 pages to explain the concept. The following provides defines the concepts of needs and the role of technology and society in enabling (or limiting) the environment's contribution to sustainable development.

It contains within it two key concepts:

The concept of 'needs', in particular the essential needs of the world's poor, to which overriding priority should be given; and

The idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs. (World Commission on Environment and Development, 1987, p. 43)

In a preceding chapter, the report noted that current growth trends were unsustainable, with a economy that “could grow five to ten fold in the coming half-century” (World Commission on Environment and Development, 1987, p. 4) and a population that “could stabilize at between 8 billion and 14 billion sometime next century.”¹(Ibid, p. 4) The disturbing part of these two facts is despite the explosive growth in the economy and populations, the number of poor is increasing since the economic growth occurs in more developed countries with stable populations and the population growth occurs in less developed countries that have stagnant or declining economic growth. In the chapter defining sustainable development, there is an emphasis on reducing the plight of the world’s poor through economic growth not only in the least-developed nations but in the most-developed nations as well. The requirement of growth in the most-developed nations is so the most-developed nations will invest the extra income into capitals in the less developed nations. This international investment component calls for globalization and trade liberalization, which is the focus of later chapters in the Brundtland Report. (Hoyer & Naess, 2001)

For the WECD, economic growth, determined by an increase in per capita income, is a panacea for resolving the inequities in living conditions between nations. Of great concern are the living standards in those countries that have the lowest income per capital. In order to alleviate poverty, the Brundtland report suggest that as minimum Africa and West Asia should experience 6% growth per annum, 5.5% growth in Latin America and 5% in the developing countries of Asia. Developed nations should be experience a 3% annual economic growth in order to expand the global economy and provide opportunities for investment in the faster growing less developed nations and create a market for commodities and goods produced in the less-developed nations. For sustainable development to occur, economic growth, in the form of income growth is mandatory.

Income levels, however, has not grown at the rates necessary for sustainable development. The following charts display the GNI per capita based on purchasing power parity (PPP). PPP GNI is gross national income (GNI) converted to international dollars using purchasing power parity rates.

¹ While these facts are used as an argument to change the quality of growth in the Brundtland report, they have been (mis)cited in the steady state literature as the desired outcome of the Brundtland report, a clear misunderstanding of the intent of including these facts in the report.

An international dollar has the same purchasing power over GNI as a U.S. dollar has in the United States. GNI is the sum of value added by all resident producers plus any product taxes (less subsidies) not included in the valuation of output plus net receipts of primary income (compensation of employees and property income) from abroad. ²

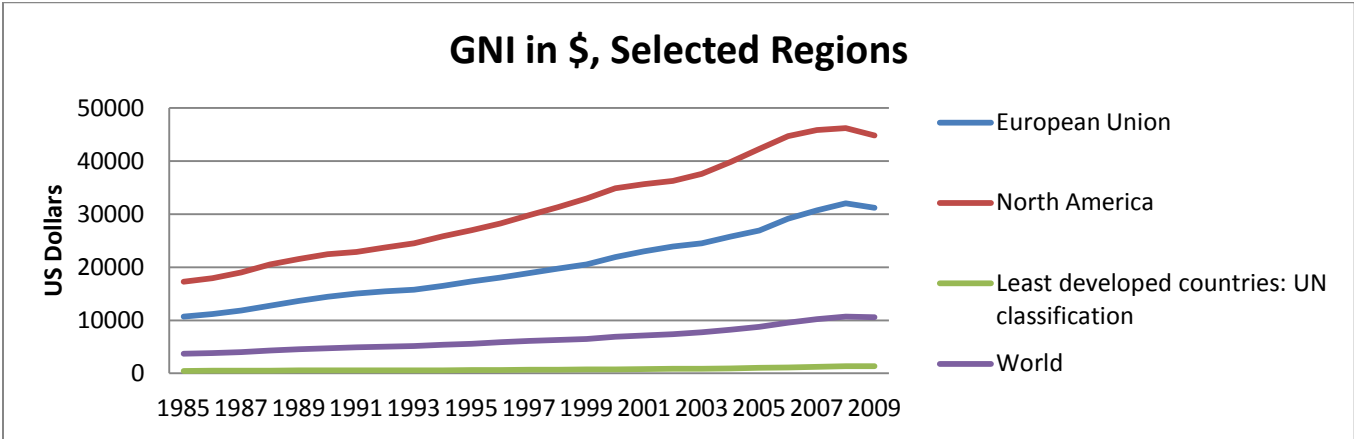


FIGURE 1 INCOME PER CAPITA, MOST DEVELOPED COMPARISONS

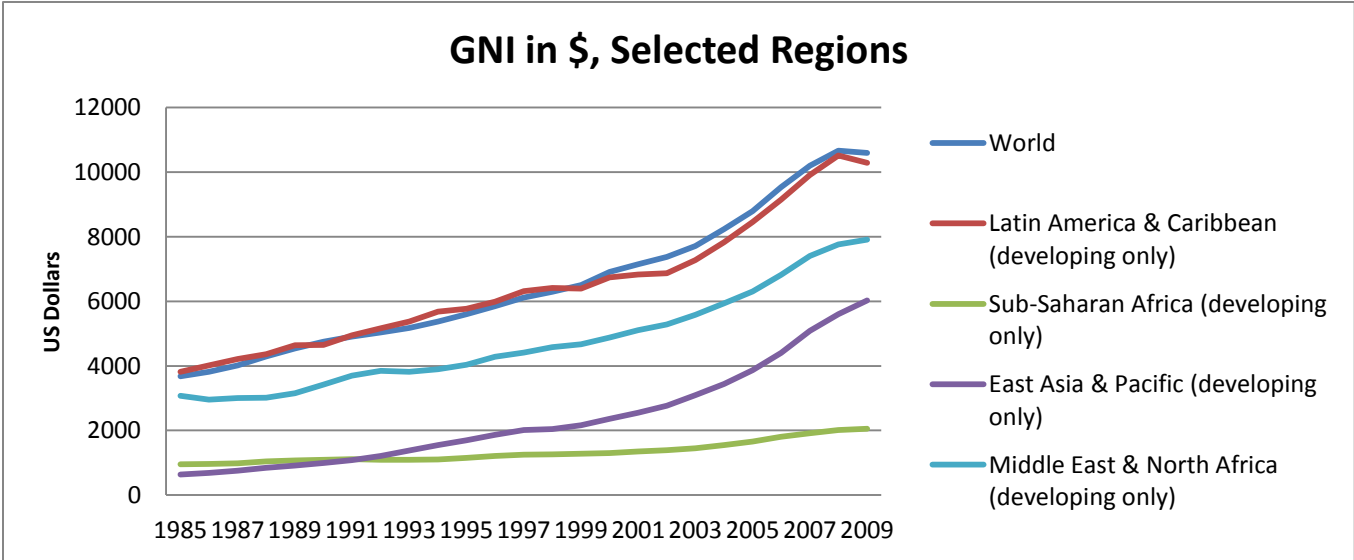


FIGURE 2 INCOME PER CAPITA, LEAST DEVELOPED COMPARISONS

² Data and Data Definitions retrieved from <http://data.worldbank.org/indicator/NY.GNP.PCAP.PP.CD>

NEOCLASSIC RESPONSE TO ECONOMIC GROWTH IN SUSTAINABLE DEVELOPMENT

The neoclassic economic viewpoint is the mostly widely accepted in the Common Era and its theories, laws and postulates guide national policy in most developed nations. Neoclassic economists accept economic growth as an absolute necessity in advancing the human condition. Economic growth is measured by either the gross domestic product, GDP, or gross national product, GNP. Both are measures of total economic activity in a nation, the only difference is that GNP includes gains from foreign investments minus the domestic income earned by foreign nationals. There have been many responses to sustainable development in the neoclassic economics literature, but the writings of Nobel laureate Robert Solow has been given special attention since he won the Nobel Prize for his theories on economic growth.

Solow is in agreement with the Brundtland Report in that economic growth through increased consumption is a way to alleviate current poverty but warns that by doing so you may negatively affect future generations. The real enlightenment in Solow's paper is his understanding that intergenerational distributional equity requires a consideration of intragenerational distributional equity. You cannot be concerned for the welfare of future generations and at the same time ignore disparities in human welfare today. This brings about an interesting paradox. If a society is concerned about intragenerational equity then it may view increased consumption as a vector for diminishing that disparity since consumption increases production, which results in increased employment. Increased consumption, however, may reduce the intergenerational legacy required for sustainable development as less resources become available to the future. (Solow R. M., 1991)

According to Solow, a path to sustainability requires a different method of national accounting. Since most countries measure economic well-being as increases in GDP, which does not account for depreciation of natural capital, a path to economic growth is available by exploiting natural resources. This is an unsustainable path. Net National product, NNP, does account for depreciation of capital resources but does not account by the manner or rate in which natural resources are consumed. Solow argues that national economies should pay themselves for depleting natural resources and invest those payments as part of the intergenerational requirement of sustainability. This methodology works as long as you, like Solow, believe in the infinite substitutions of capitals as factors of production. As long as the total amount of production capital does not decrease, economic activity can continue to grow. (Solow R. , 1993)

THE STEADY STATE ECONOMY

Steady State economists believe that there are limits to economic and human growth, and are critical of the neoclassic viewpoints on economic growths and capital substitutability. *“Thus, continual growth in both capacity (stock) and income (flow) is a central part of the neoclassic growth paradigm. But in a finite world continual growth is impossible.”* (Daly, Introduction to Essays toward a Steady-State Economy, 1993) These are the words of Herman Daly, the leading advocate for a steady state economy, and these are the fundamental arguments against continual undamped economic growth. The steady state economist believes that the world has a finite amount of resources and more importantly a fixed flow of energy. This limitation prevents the economy from growing beyond a point of economic collapse when either natural resources are depleted or energy needs exceed available energy flows.

A steady state economist views the economic system as an open system within a closed ecosystem as depicted in figure 3 below. Solar energy flows into the ecosystem and heat escapes.

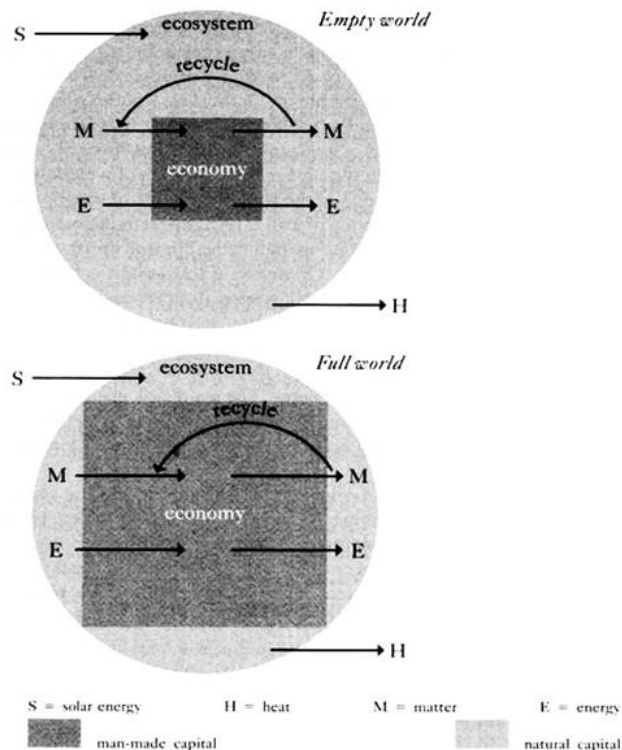


FIGURE 3 THE ECONOMY AS AN OPEN SUBSYSTEM OF THE ECOSYSTEM

(DALY, BEYOND GROWTH, 1996, P. 48)

All matter is contained within the ecosphere and is finite in quantity. Matter and energy are transformed from natural capital to manmade capital within the economic subsystem and waste matter and energy is returned to the ecosystem. Some waste matter can be recycled into useful natural capital for further transformation into man-made capital. As man-made capital increases, natural capital decreases until there is little natural capital left to transform. The energy available to the system is the energy available as natural capital, which cannot be recycled, along with the solar energy flows (minus any waste heat expelled by the ecosystem). The rate of economic activity is regulated by energy flow, which, after depletion of natural capital energy sources, is limited to a fixed flow of solar energy. A steady flow of energy implies a steady state economy. (Daly, *Beyond Growth*, 1996)

According to Daly (and others), sustainable growth is an oxymoron. Economic growth is only possible when the economic subsystem has not yet grown to the size of its bounding ecosystem. Once that ecosystem boundary is reached, true economic growth stops. (Daly, *Sustainable Growth: An Impossibility Theorem*, 1993) For sustainability to occur, growth, defined as quantitative expansion, must be replaced by development, which Daly defines as qualitative improvement. You can have sustainable economic development but you cannot have sustainable economic growth. (Daly, *Beyond Growth*, 1996)

One example of the limitations of the ecosystem to support human growth was explored by Peter Vitousek, Paul R. Ehrlich, Anne H. Ehrlich and Pamela Matson in a 1986 paper, *Human Appropriation of the Products of Photosynthesis*. To conduct this research, the authors calculated the total amount of the products of photosynthesis, NPP that was consumed or appropriated by the human race. In their final tabulation, the authors estimated “*that organic material equivalent to about 40% of the present net primary production in terrestrial ecosystems is being co-opted by human beings each year.*” (Vitousek, Ehrlich, Ehrlich, & Matson, 1986, p. 372) At the time of the study, the earth had a population of 5.4 billion people. Assuming linearity between population and appropriation of NPP, you can extrapolate if population grew to 12.5 billion, the human race would appropriate 100% of the NPP. This would also mean humans would be the only surviving animal species.

THE CONTRIBUTIONS OF NICHOLAS GEORGESCU-ROEGON

Nicolas Georgescu-Roegon’s writings on entropy and economic systems are heavily referenced in the academic literature of steady state economists and economic degrowth advocates.

Georgescu-Roegen views economics as a thermodynamic process, bound by the classic laws of thermodynamics. This radical approach threatened to deconstruct classic and neoclassic economic theories. Much of his writings were published in the early 1970's but it was ignored by mainstream economists and was discovered by ecological economists in the 1980's and the degrowth movement in the late 1970's (Martinez-Alier, Socially Sustainable Economic Degrowth, 2009)

In the Georgescu-Roegen model, economics is a function of energy and energy is subject to the laws of entropy as defined in the second law of thermodynamics. Entropy can be defined as the availability of energy to do work, high entropy energy is unavailable to do work and low entropy energy is easily available to do work. High entropy energy is dissipated heat and fossil fuel and solar are low entropy energy sources. As work is being performed, energy flows from low entropy to high entropy. Energy can be converted from high entropy to low entropy by the application of work but it requires more work than is made available through the opposing conversion of low to high entropy. Thus using energy to do work and using work to make energy is a zero-sum game, eventually all energy will become high entropy energy (heat) and no more work can be performed. *"All kinds of energy are gradually transformed into heat and heat becomes so dissipated in the end that man can no longer use it."* (Georgescu-Roegen N. , 1975, p. 352)

An example of this energy entropy relationship can be explained using a hourglass analog as Georgescu -Roegen once explained to his student Herman Daly. An hourglass full of sand is an isolated system (as defined in classic thermodynamics) since no sand enters and no sand leaves. Since there is a fixed amount of sand, the hourglass subscribes to the first law of thermodynamics. As the hourglass is flipped sand flows as a constant rate from the upper (low entropy) portion to the lower (high entropy) bottom portion.

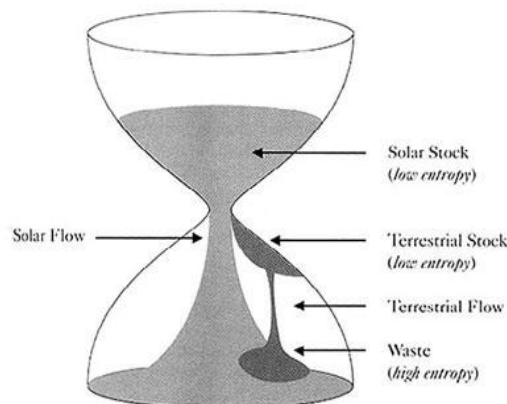


FIGURE 4 ENTROPIC HOURGLASS

(Daly, Beyond Growth, 1996, p. 28)

Once the hourglass is flipped, it can never be flipped again, so as low entropy sand (energy) flows to become high entropy sand (energy) it can no longer be transformed. The dark sand stuck to the top of the bottom section of the hourglass represents the low entry terrestrial stocks (fossil fuels) of energy. If this hourglass analogy is extended into economics then economic activity is regulated by the flow of sand from the top to the bottom of the hourglass. (Daly, Beyond Growth, 1996)

Steady state economists have used the Georgescu-Roegen energy entropy arguments to support their argument that within their economic subsystem, the fixed flow of solar energy determines a steady state condition of the economy. To this claim, Georgescu-Roegen responded as follows:

This vision of a blissful world in which both population and capital stock remain constant, once expounded with his usual skill by John Stuart Mill, was until recently in oblivion. Because of the spectacular revival of this myth of ecological salvation, it is well to point its various logical and factual snags. The crucial error consists in not seeing that not only growth, but also a zero-growth state, nay even a declining state which does converge towards annihilation, cannot exist forever in a finite environment. The error stems from some confusion between finite stocks and finite flow rate, as the incongruous dimensionalities of several graphs suggest. And contrary to what advocates of the stationary state claim, this state does not occupy a privileged positions vis-à-vis physical laws. (Georgescu-Roegen N. , 1975, p. 367)

Georgescu-Roegen also advocates for a minimal bioeconomic program where consumption is kept at a bare minimum. In his arguments, Georgescu-Roegen asserts that this is the only way to meet the intergenerational tenets of sustainability. The present has an absolute dictatorship over the future and the only way to preserve future interests is by leaving as much capital stock as possible. The present has to make a choice to consume less and live within available solar flow of energy. The reduced demand offsets the scarcity of supply. Georgescu-Roegen provides eight suggestions for enabling an economic of least consumptions. 1) War and all its instruments should be prohibited. 2) The standard of living in poorer nations should rise. 3) Population should shrink to level supportable by organic farming. 4) Use Solar energy or controlled fusion, no energy wasting is allowed 5) End extravagance 6) Get rid of fashion 7) Make durable goods more durable and repairable 8) A good life is increasing amount of leisure spent in an intelligent manner. (Georgescu-Roegen N. , 1975)

DEGROWTH <-> DÉCROISSANCE

Décroissance (French for degrowth) provides a very interesting proposition; the path to sustainable development is not growth or development but de-growth. De-growth is a francophone proposition that began in the late 1920's, after WWI and the depression, and is strongly influenced by Marxism. Its focus was on quality of life and in solidarity among people. The movement is the source of the "think globally, act locally" slogan one often hears around the sustainable and green movements. The movement grew from Georgescu-Roegen's work on the thermodynamic applications to economics, and Georgescu-Roegen has become known as the father of de-growth (Martinez-Alier, Pascual, Vivien, & Zaccai, 2010).

The de-growth movement is gaining strength in Europe as a result of the failures of sustainable development to show any advancement and the "*continuous environmental and economic crises compounded by a growing disjuncture between the real economy (in which the value of natural capital is seldom recognized) and the fictitious paper economy of finance.*" (Martinez-Alier, Pascual, Vivien, & Zaccai, 2010, p. 1741) In the United States, the steady state economic paradigm has taken precedence among the critics of the current neo-classic paradigm. It is unfortunate that the bulk of the academic literature on degrowth is in French since the linguistically challenged Americans are unable to benefit from reading it. Some key components of de-growth have already been implemented in France such as reduction in labor hours (35 hour standard work week) and socialization of many public services such as Health Care. French de-growth also has a focus on autonomy at the individual community and regional levels. (Martinez-Alier, Pascual, Vivien, & Zaccai, 2010)

Advocates of the degrowth movement are quick to point that their movement is not an opposite of economic growth but a fundamental shift away from the current chrematistic economic system prevalent in modern industrialized nations. Degrowth economics is a model for affluent societies and calls to "*depart from the promethean economic growth paradigm and to embrace a vision of sustainable de-growth, understood as equitable and democratic transition to a smaller economy with less production and consumption.*" (Martinez-Alier, Pascual, Vivien, & Zaccai, 2010, p. 1741) Degrowth is a revulsion of the current economic fixation with growth as Valerie Fournier explains;

But degrowth is not just a quantitative question of doing less of the same, it is also and, more fundamentally, about a paradigmatic re-ordering of values, in

particular the (re)affirmation of social and ecological values and a (re)politicisation of the economy. It aims to take us out of the economy, of the domain of the calculable and economic rationality, and ask fundamental questions about the nature of wealth, its distribution, its use, and misuse. Thus degrowth is not just a quantitative question of producing and consuming less, but a tool proposed for initiating a more radical break with dominant economic thinking. (Fournier, 2008, p. 532)

One of degrowth movement's key criticisms of modern neoclassic economics is the trifurcation of the economy into three levels. The first level is a purely chrematistic level. It is the level of the moneylenders; it grows by lending money to the private and, at times, the public sector. Since loans are made with the expectation of returns with interest, economic growth is mandatory as the future must satisfy the increased obligation of the borrowed monies. Since these financial institutions generally loan more money than what is available in deposits, it needs a constantly increasing economy for its debtors to satisfy their obligations. (Martinez-Alier, Socially Sustainable Economic Degrowth, 2009)

The second level is the one often described as the real economy. This level is the producer level and includes manufacturing, technology and innovation. Since return of investments is the key to attracting investments this level often advantages by borrowing money from the first level. The debt obligations and equity obligations require that the productive level must constantly expand and grow to satisfy its financial commitments. If a productive firm cannot grow fast enough, it will default on its obligations. (Martinez-Alier, Socially Sustainable Economic Degrowth, 2009)

The third level is the real-real economy where the actual flows of materials and energy reside. This level grows based on economic factors; supply and demand, markets, prices and all the other standard economic factors undergraduate university students having been studying intently for years. The degrowth movement seeks to eliminate the top two levels as those levels provide little value and only inflate true economic activity. (Martinez-Alier, Socially Sustainable Economic Degrowth, 2009)

COMMENTS AND CONCLUSIONS

Three possible approaches to economic growth have been presented and each has merits and detractors. The Brundtland Commission and neoclassic economist advocate for growth as the

vector for solving poverty and embarking on more environmental sensitive production. The steady state economist view neoclassic economy as flawed and believe that economies are limited by biophysical realities and the economies must adjust to a steady state. The degrowth movement advocates for a simpler life outside of the economy, it is not so much a degrowth movement as an agrowth movement, it simply does not care about growth, it is concerned with life. Which is the best approach is dependent on the values of whoever is asked the question. A better question is which is best for sustainable development and the planet?

This paper examined only one aspect of sustainable development, the role of economic growth and discovered that the entire spectrum of possible outcomes from forceful economic growth to complete abdication of economic growth all claimed to support economic development. The answer simply begs more questions as to the nature of sustainable development and whether it useful as a tool to solve the world's ills. The problem is for any of the economic approaches presented their must be a global acceptance of the approach. Barring some catastrophic event to unite the planet, consensus on anything at the global level, let alone something as polarizing as economics, is problematic.

Many years have passed since the 1972 publication of the *Limits to Growth* and the 1987 publication, *Our Common Future*. There have been many more books written on sustainable development and the concept has grown wide acceptance in academic circles. Universities are offering courses and designing full courses of study on sustainable development. Centers for sustainable development are appearing in the public and private sectors. With all this activity centered on sustainable development, are we becoming more sustainable?

The work that needs be done in sustainable development is not theorizing but actualizing. The global inequities in income are increasing, leading to conflicts in the Middle East and Near-East Muslim countries. There is little movement away from fossil fuels and the renewable energy technologies are still embryonic. Large national deficits threatened future generation's chance at prosperity. Whatever needs to be done needs to be done soon.

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