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SUSTAINABILITY AND GROWTH – A STUDY IN ENVIRONMENTAL EPISTEMOLOGY

Summary. Sustainable development is sometimes taken to mean stagnation and even civilizational regress. This is based on the philosophy that treats the Earth as an overcrowded lifeboat, which originated with P. Ehrlich. This approach is based on two theses: A general thesis, that the Earth has some limits to its carrying capacity, and an empirical thesis, that the Earth is about to reach the limits of carrying capacity. The general thesis is true, in general terms. To support the empirical thesis Ehrlich and the Club of Rome presented a testable hypothesis (shortages of natural resources and food). Those predictions failed to materialize. Currently, the empirical thesis is supported largely by intuitions. The view of the Earth as overcrowded leads to pessimistic and anti-humanist approaches. A better vision, proposed by Elon Musk and recent environmental epistemology, shows that civilizational development gives us a better chance to solve the real environmental challenges.

Keywords: environmentalism, growth, sustainability, sustainable development, Musk, Ehrlich, Bisk, bottlenecks in development, water desalination, mangrove trees, GMOs, technological growth, green technology.

ZRÓWNOWAŻONY ROZWÓJ JAKO ROZWÓJ – STUDIUM Z EPISTEMOLOGII ŚRODOWISKA NATURALNEGO

Streszczenie. Zrównoważony rozwój niekiedy traktowany jest nie jako rozwój, ale stagnacja lub regres cywilizacyjny. Podejście takie, które zapoczątkował P. Ehrlich opiera się na filozofii traktującej Ziemię jako przeładowaną tratwę ratunkową oraz na dwóch tezach: Teza ogólna, iż Ziemia ma maksymalną zdolność uniesienia pewnej ilości ludzi, oraz teza empiryczna, iż Ziemia niedługo osiągnie taką granicę. Teza ogólna jest w generalnym sensie prawdziwa. Na poparcie tezy empirycznej Ehrlich i Klub Rzymski przedstawili testowalne hipotezy (przewidywano kryzys surowcowy i żywnościowy), które nie sprawdziły się. Obecnie teza empiryczna jest wspierana jedynie za pomocą zachowawczych intuicji. Podejście do Ziemi jako przeludnionej ma pesymistyczne i anty-

humanistyczne konsekwencje. Lepszą wizję proponuje Elon Musk i nowoczesna epistemologia środowiska naturalnego, która pokazuje, że rozwój cywilizacyjno-technologiczny daje najlepszą szansę rozwiązania problemów środowiska naturalnego.

Słowa kluczowe: enwironmentalizm, rozwój, zrównoważony rozwój, Musk, Ehrlich, Bisk, wąskie gardła w rozwoju, gospodarka wodna, odsalanie wody, lasy mangrowe, GMOs, rozwój technologiczny, green technology.

Part I. Regressive or Progressive Environmentalism

1. Rational use of the Lifeboat

Lifeboats need to be used when the main vessel, say a cruise ship, is in danger of sinking or capsizing. It is unreasonable and in fact goes against the safety protocol to pack the passengers on a lifeboat when the main vessel is not in serious danger. As a member of the Advisory Board of the Lifeboat Foundation[1], an organization created by the leaders of the environmental movement of the 1960s and 1970s, my colleagues and I are often faced with the question whether we are at the level of human development in which we have reached the capacity of growth and we ought to adopt a life-boat mentality, or whether we should navigate the stormy waters in the cruise ship made possible by the socio-economic and technological progress of modern civilization. Some the intellectuals of the late 20th century, found it quite obvious that we should resort to the life-boat mentality. Yet, the core mission of the Lifeboat Foundation is "helping to accelerate the development of technologies to defend humanity". The focus is on embracing the technological and civilizational progress not on stalling it. More and more experts joining the Lifeboat Foundation, especially those who specialize in future studies and environmental strategy, tend to think that we are much better off in the vessel of modern progress than in the proverbial lifeboat.

Part I of this paper is organized according to the standards of analytical thinking. We examine the claim of Ehrlich and others to the effect that the Earth is reaching its carrying capacity. We agree with the theoretical claim, that there is such a carrying capacity that may be reached one day. We disagree with the empirical claim to the effect that such carrying capacity is presently being reached. Therefore, instead of regressing to some form of the natural economy, it would give a better prognosis for resolving environmental bottlenecks, even the challenge of global warming, if we follow the path of technological and civilizational progress. It seems that the strong intuitions, to the opposite effect, rely on the traditionalist epistemology, always suspicious of progress and change. Hence, Part II of this paper is

[1] See http://lifeboat.com/ex/bios.peter.piotr.boltuc.

devoted to the discussion of environmental epistemology. This part is organized according to the Continental intellectual discourse, which seems better suited for the topic.

Sustainability Defined

Traditionally sustainability was not quite associated with the lack of progress. The 1828 Webster's dictionary defines sustainable as what "may be sustained or maintained."[2] A sustainable farm, for example, was the one with the resources to sustain its production: if you wanted to raise 200 horses you had to have the hay, the water and the shelter (in most climates) to get them through the winter. Things can also be financially sustainable, or unsustainable: a household that spends $600 on a $450 fixed income is unsustainable. Today the idea of sustainable growth relies, to some degree, on those earlier ideas; sustainable growth means the level of growth that can be sustained (environmentally, economically and otherwise). Yet, many authors writing on sustainability today presume that growth runs counter to sustainability, especially to the growth of population and to the economic growth (defined by standard economic measures such as GDP). This point comes, rather directly, from the prognostics of Ehrlich, Harding and the Club of Rome. Those works, published mostly in the 1960s and early 1970s, may be analyzed in terms of two theses: First, there is a certain carrying capacity of Earth above which more population and/or economic growth would be unsustainable. Second, we are nearing the point of reaching and overpassing such carrying capacity. Those premises, coupled with a very reasonable presumption that we do not want to go over the carrying capacity of the Earth, lead to the conclusion that we should reverse growth. The argument is formally sound, namely the conclusion follows from the two premises (and the very intuitive presumption).

The first premise also seems sound. In principle, there are limits to the capacity of everything: the heaviest track can carry only that much load. Some authors tried to question this premise by claiming that we could minimize the load faster than we add the new pieces to it. For instance, on a lift, if we replace one elephant with seven cocker spaniels we'll still have much extra weight left. This argument is interesting but it does not work forever – or rather it would require a very odd physical theory to go with it[3]. Under the regular circumstances, even the lightest and/or the smallest physical objects, if taken in sufficiently large numbers, could add up to any weight and size. Hence, Ehrlich's first premise has to be accepted: there is some carrying capacity of Earth.

Whether the second premise is sound is an empirical fact. In fact Ehrlich and the Club of Rome clearly take it as an empirical fact – it is a matter of environmental science, other

[2] http://1828.mshaffer.com/d/search/word,sustainable.We want to thank graduate students at the University of Illinois Springfield: Roel Ybarra, Daniel Rush and especially James McGennis for their helpful comments and suggestions on different parts of the paper.

[3] If we presume a stable carrying capacity, the argument would imply that things of the relevant kind can be lighter and lighter forever, or even that they could gain a negative mass and become less heavy than zero.

related natural sciences and economics whether we are close, or very far from reaching the carrying capacity of Earth. It seems that at least Ehrlich, probably the first and best proponent of this view, had two arguments to this effect: First, scientific and second, based on the common sense. (It seems that the Club of Rome followed primarily the former route whereas many environmental writers the latter.) According to the scientific route there are empirically testable reasons to believe that we are already reaching the carrying capacity of the Earth. Both Ehrlich and the Club of Rome formulated testable hypotheses to this effect. They predicted that by the late 1970s there would be sharp and increasing shortage of fossil fuels, minable materials and food resulting in price increases. They also predicted, as a consequence of those shortages and the resulting price hikes (especially of the food shortages), sharp increases in global poverty. At first those hypotheses seemed to come true faster than the authors predicted; the 1970s oil crisis resulted in shortages of fuel and thereby increases in the price of food. Yet, by the late 1970s the price of oil started going down and the other prices followed. Today the prices of food, petrol and most minable materials are record low by historic standards. The exception are usually two or three rare metals (such as molybdenum) that happen to be demanded by some cutting edge technology (such as the cell-phones) – those materials, and even the whole technologies, eventually get replaced by less expensive substitutes. Also, the level of global poverty decreases gradually. This is the case despite the other negative social processes, unrelated to the issue at hand, such as the fact that the level of poverty is still high and worth of moral concern, and that the level of the divide between the poor and the rich increases alarmingly. Followers of Ehrlich and Hardin tend to acknowledge that the predictions did not come through and argue that the crisis is just around the corner. Yet, those arguments do not get support in empirical facts. New technologies, including development of GMOs, result in increases of food production. Hence, the argument that supports Ehrlich's thesis that the crisis is happening now or is going to materialize very soon belong to the second route, the one that relies on common-sense intuitions not upon scientific facts.

The arguments of this kind rely on strong and natural intuitions. Those are the intuitions that the world is changing and many things of the old perish, replaced or destroyed. Unbeknown to most of the authors those arguments are conservative at their core, and many of the similar points have been made already by Burke in his debate with progressivism. This is not an argument against those claims just an odd configuration of political sentiments. The problem is that such intuitions are restricted to a given historical context and as such do not constitute an argument. We can imagine the reaction of hunters-gatherers when faced with the first agricultural societies. They would dread not only the loss of the original habitats and the wildlife but also of relative personal freedoms of the early tribal society. The hunters gatherers would also be terrified how so many people could survive off of such small pieces of land. The same surprise, bordering on horror, faced human beings every few generations

when new technological or social arrangements came into place. The industrial revolution and steam engine are just two of the recent changes of monumental proportions. Nearly every generation has intuitions that their challenges are overwhelming and unsurmountable, those intuitions prevail until the new watersheds appear. Intuitions of the environmentalists of the 1960s are no exception to this. If those intuitions to the effect that we are about to reach the carrying capacity of the Earth were supported by strong scientific facts they would carry much weight but as we have seen above they are not. Remember that the support cannot be limited to the proof that environmental conditions are worsening in some manner (they were worsening when we moved from hunting gathering to agriculture and many other times since) – they would have to show that the new conditions are unsustainable in the strictest sense of the term. Ehrlich and the Club of Rome defined those conditions in very clear and plausible terms (shortages and price hikes of food and natural resources), which allowed us to see very clearly that those conditions have not been met. Without overwhelming scientific support intuitions alone do not add any argumentative strength though they do produce emotive meaning as well as some social support.

The fact that the empirical argument developed by Ehrlich and taken up by the Club of Rome has failed does not need to lead to the rejection of the first premise of Ehrlich's argument: we may near the carrying capacity of Earth one day. The second, empirical, premise is not satisfied. Cornucopian critics of Ehrlich may be wrong on many things, but they do provide a good explanation why the empirical premise is not satisfied at this point: In highly developed societies, human ingenuity and technological development progress about as fast, maybe faster than the burdens created by growth. Yet the cornucopians seem wrong that this process is necessarily going to continue for a very long time – this latter claim is also empirical and requires us to be checking empirical facts, periodically. We need to be on the lookout for the facts that would indicate that the limits to growth appear on the horizon. The empirical fact today is that we have no better reasons to expect the carrying capacity of the Earth to be reached now than we would have had at the generation of the late hunters-gatherers stunned by the early agricultural society.

What we face today are the bottlenecks of civilizational growth; some of those bottlenecks are primarily economic or social but some are primarily environmental. One such real problem is the shortage of sweet water in many areas; another one, that looked very serious even a decade ago but now seems to have been resolved to a large degree, is the shortage of energy. Those bottlenecks should be viewed as specific problems for us to solve.

There seems to be only one problem that does not fit easily with the above problem-solving strategy – the problem of global warming. It is particularly complex since it involves a whole set of environmental, socio-economic and political problems.

2. The Bottlenecks as an Opportunity for Technological Progress

Technologically, we could enhance food, energy and water production (as well as decrease the need for the latter two) in an environmentally friendly manner as well as enhance our sewer treatment and transportation efficiency. Some of those technologies, such as hybrid cars, now become main-stream on consumer markets. The main reason why advanced technologies do not reach the market even faster is the fact that there is no shortage of energy, food and in many areas even water – surprisingly, in some areas with major water shortages such as California it is still heavily subsidized. Consequently, the prices based on the traditional technologies are overly low to justify investments in technological chance, which therefore rely heavily on government subsidies. In the next section we shall focus on some of the technological solutions to the environmental challenges.

There may be a tendency to view some of those recommendations as science fiction or vague ideas. The ideas are grounded in futurology, which is the science developed by many corporations and governments. Futurology does involve many variables and therefore may sometimes lead to misleading outcomes (we have seen that futurological predictions of The Club of Rome pertaining to the upcoming price increases of food and natural resources in the last decades of the last century did not come true at all). However, below I discuss the technologies that have been developed at least at the test of the concept stage and the main reasons for the lack of their further development are economic. The future thinking, while consistent with the tenets of economics, requires the conditions of human thrivability that that regulate those limitations of economic thinking through social choice and occasional involvement of democratic political will.

Be well and prosper – ideas on growth

What are the ways for us to be well and prosper, event thrive, while keeping environmental balance? – This is the right question to pose within the scope of environmentally friendly humanism. We need to search for human flourishing – which, as both Riccardo and Marx emphasize, requires economic and civilizational growth. In the article I wrote with Tsvi Bisk (for the anthology edited by Lech Zacher) we discuss a number of those issues in detail. Here I address some of the topics that may be of special importance.

The three relations between business and the environment

Just like in most areas of applied ethics, there are three ways in which business can relate to values: First, what is good for business is also environmentally good. In business ethics this approach is known by the saying *ethical business is good business.* Indeed, oftentimes when we give good, honest service to our customers they are more likely to do business with us in the future, which overall tends to be good for the business. In environmental ethics this

position is prominently represented by Porter. According to Porter's idea of *green and profitable* every environmental pollution is a waste of some materials, which can be re-used. Hence, according to this optimistic view, in a long run, efficient business operations and environmental values coincide. Quite obviously, while this idea is largely true in an efficient (and well-regulated) economy it is not going to help much with species preservation or global warming.

The second approach emphasizes that, while in certain situations business value is not enhanced if we adhere to some specific moral standards (including high environmental standards) it is also not decreased by doing so. Among many good business strategies a company may choose, there is at least one that is compatible with environmental (or other moral) standards. If so – applied ethics teaches – we should adopt such standards since there is no cost, or it is negligible.

Third, quite importantly, business value and environmental (or other moral) values may collide. They sometimes do, even in a well-organized society. In such scenarios, what is good for business is bad for the environment (or other morally worthy causes) and *vice versa*. This is the scenario that Porter neglects, or even denies that it ever happens; but it does happen. One of the advantages of a well-ordered society is that such conflicts between moral interests and business interests do not emerge often and that there are procedures to resolve them. This is achieved in part by efficient fair regulation and its enforcement and in part by democratic choice at various levels of governance.

Even in well-ordered societies environmental conflicts of the latter kind occasionally occur. The same patch of land, of some environmental value but not so high as to deserve the status of a national or local wild-life preserve, can be either used for development or for conservation and low-intensity tourism; some endangered species may be benefited by not building a certain road, or factory, while those investments are needed in the community (the Rospuda river wild-life area and competing interests of building a much needed international highway is a real-life example from Poland). While in those cases there are no good ready-made answers that work in every instance, usually technological progress and economic growth actually provide valuable alternatives. (For instance, a road or a shopping center may be partly located underground thus leaving ample space for environmentally friendly investments and the wild life.) In some cases political pressure may need to stop environmentally dangerous business initiatives.

The bottlenecks

While, *contra* Porter, it is true that business and technological progress is not always able to solve all environmental problems, it can solve a great many of them. Here is a list of the main bottlenecks to civilization growth and the ideas how to tackle them in economically advanced societies. As I mentioned above, most attempts at futurology fail due to the

multiplicity of largely unpredictable factors that influence civilizations in a long run. I do not present futurological predictions but rather a list of opportunities allowed by the existing technologies or those with sufficient proof of concept that, given sufficient resources, they could be put under development.

1. Food production

Most authors in the 1960s emphasized food shortages as an important limit to growth. Today global food production surpasses food demand by high margins. Famine or undernourishment are primarily economic not agricultural problem today, since they do not come from shortages of food on global markets, or from high food prices (those are low by historic standards) but from destitution of certain social groups and areas. Such destitution is often caused by political mismanagement (for instance in Yemen and North Korea) or by periodic droughts. This economic inequity is further enhanced by farm subsidies given by European Union, USA and other Western countries, which push food products from developing world out of the market. However, new even more efficient technologies exist and further ones are being developed.

The simplest such technology is genetically modified foods. There is a sharp divide between the view on GMOs in the European Union and in many other regions. GMOs are often able to enhance food production and to be adjusted to the local conditions, including water shortages. The main genetic engineer is nature since random mutations allow for the evolutionary process. Genetic engineering speeds up this process. It should not come as a surprise that the forces that are interested in keeping high prices of food products by limiting their supply are obviously unhappy with efficiency increases allowed by genetic engineering. The EU politics has made them largely illegal. While there are some cautionary reasons[4], those restrictions are often interpreted outside of the EU as one more form of protectionism of inefficient and overpriced farming practices. This last issue is beyond the scope of this paper.

The main truly new strategy in agriculture is factory farming. It is important to mention that I do not engage in any science fiction but I describe an enterprise that I visited, in Chicago, with a delegation from University of Illinois. Similar factory farms have been developed in Detroit and elsewhere. A 10 story building with two arable areas per floor we add 20 fields of the size of one. Thanks to the controlled climatic conditions each field produces about twice the amount one would harvest from a traditional farm. This adds up to the equivalent of 40 fields at the size of one. Those fields recycle and reuse about 80% of the water, and produce a large percentage of energy as a combination of solar panels, thermal energy and bio-gas that comes from recycling farm waste. Present quality of production can be compared to hydroponic tomatoes, which means not the top, but also not the bottom of the

[4] As any new food or medical products, genetically engineered organisms may have some unexpected side-effects, and so genetically modified foods need to be tested with due diligence.

line, but quality improvements are very attainable with further research. Today the limiting factor on factory farming is the cost of entry into the business, namely of the construction of such farms. While factory farms located in or near the large cities are economically viable to operate even with the current low prices of food, it would be nearly impossible to pay back for the large investment needed for their construction, especially now when few of them are being built and so the economy of scale in their production is not realized. The ones that exist have usually been built in the existing factory buildings with large concrete constructions, in which cases the cost of demolition would have been higher or about as high as the cost of turning them into factory farms.

The other food production techniques developed for the last half a century include bioengineering of proteins based on krill and other sources (developed in Poland and Japan in the 1970s) and newer attempts (mostly by Japanese companies) of bio-mass creation based on bacteria or algae growth. If such technologies reached the market, every family could produce enough bio-mass to satisfy most of its nutrition needs in the space of a refrigerator. Then the same machine could produce varieties of food products from such protein as easily as a coffee-maker can make cappuccino, latte and other kinds of coffee. The current low price of food does not allow for investments in those areas but the technology is promising.

2. Water

There is a thorough discussion of water techniques in [Bisk, Boltuc] since my co-author of that paper, Tsvi Bisk, is an expert on the issue. Briefly, the main strategy to provide enough water is to eliminate waste (Non-Revenue Water) due to water leaks. Such waste amounts to about 60% of water production so increases of efficiency of water delivery by 20% would result in increases of available water by 12% of the total production of fresh water. Recycling water, harvesting water from the air (the way the redwoods and some other trees do) and using run-off water (for instance rain water) are some of the other sources of water production that are important in certain environmental predicaments.

While desalination of sea-water and brackish water (the somewhat salty water that can be found underground, including many deserts) is expensive, those costs can be decreased as the cost of energy production goes down. Desalination is an important source of water in certain areas such as deserts and ocean islands. It can be combined with farming based on salt-tolerant plants, such as mangrove forests. We may use the genes of mangrove trees to try to increase water resistance of existing agricultural products [Meera *et al*]. We may also try to bio-engineer mangrove trees in order to increase the two features that limit their current use: to produce food-quality products and two to grow in a way that would allow for easier machine harvesting. Since agriculture is the biggest user of fresh water (almost 80% in the US), the use of salt water for agriculture, as well as limitation of need for fresh water that

comes from developing factory farms, and also bioengineering plants characterized by lower need for water, would decrease the need for fresh water in general.

3. The Energy

Recent decreases in energy costs may be short-living but the general trend to diversify the sources of energy, from petrol, gas and coal, through atomic, all the way to solar and geothermal energy is the right way to go. The low cost of energy from the traditional sources makes the use of alternative energies more of an environmental luxury heavily subsidized by some governments. Whenever non-renewable energy sources become scarce, this would be reflected by price increases of the energy produced. If the price of energy increases, with some investments and research we would have enough energy sources (including atomic and solar) to nearly replace non-renewable energy. To mention just one rather new technology: Solar energy transferred to the surface of the Earth from the orbit may become a reliable energy source since it does not depend on the day-night cycle and would be affected only by extreme weather conditions. Just like in the previous sections, there is no science fiction thinking here since all of those technologies are currently in use of in the stages of commercial development.

4. Transportation

Efficient cars and busses guided by robotic drivers are already at the beginning of their implementation stage. Electric cars and other eco-friendly vehicles are now reaching mass-markets around the world. Vehicles built out of the extra light materials, such as the bucky paper, seem to be the next step of development. They would be more energy efficient and potentially safer.

In terms of mass transportation, as the cost of digging tunnels decreases rapidly, it becomes easier and easier to build subways as well as underground tunnels, roads and parking garages (such as the different levels of Wacker street in Chicago IL). The old idea of the hyper-loop, transportation by individualized micro railroad-cars electronically guided in groups within a system of pipes (renewed by Elon Musk) may be the way of the future. It combines individualism of car transportation with efficiency of the subway and ubiquity of the plumbing system. In one version of such system, each household would have access to a personalized car compartment, perhaps doubling as a living room couch, which would get into a capsule and be sent from their condo to any chosen destination by a system of pipes, similar to the water-sewer system. Compartments would go in the main pipes, similar to the highways, where the system would use optimized intersections and electronic switches to guide them to their destination. If the system is fully automated it would allow for the most efficient individualized transportation within large agglomerations. As we put it elsewhere: “The reason why it is slow to develop is that it is viable only in heavily populated areas, and present-day human centers are not sufficiently urbanized. Such transportation would only

make sense within and in the areas surrounding Holland; near Tokyo, NYC and maybe a few new metropolises." [Bisk, Boltuc] If the Earth ever becomes more highly populated by advanced societies, further development of the hyper-loop transportation would become an obvious choice.

5. Housing

The most expensive, and environmentally unfriendly, way to house people are the suburban homes with their green lawns. Such system requires much heating, cooling and water, it generates waist; despite the appearances it provides little environmental value and requires lots of transportation investments. The second most expensive thing are windows, not only when they generate energy losses (since those can now be prevented) but also because they require direct access to the outside of the building complex. Since modern air-conditioned housing does not allow for opening windows in most office, shopping and hotel buildings, and in many housing complexes, it is natural to replace the actual windows with the natural-light-quality light bulbs. We already have examples of comfortable condos with no windows, located in former silos for strategic nuclear installations in the US. Windowless housing can be the least expensive, but potentially quite comfortable way of the future.

It is worth noting that if the whole population of the Earth was to live in an area as densely populated as the Manhattan, including the large Central Park, then it would fit in the area of about the state of Texas living the rest of the Earth for other uses. This shows that the extremes of windowless houses are not even on the horizon but they are definitely available alternatives should we ever reach the limits of housing of the kinds that are currently predominant.

6. Waste disposal

K. F. v Weizsacker defined dirt as any product out of its proper place. Waste and pollution is a special instance of dirt so defined. The substances that consist in waste may be harmful but most of them have their uses. Porter is right that pollution and the lack of recycling is an important indication of wasteful management, although oftentimes it is justified by the current prices of raw materials, or of the semi-products, compared to the cost of harvesting them through recycling. I already covered some of the ways to recycle water. Waste disposal is an important topic of research within waste re-engineering and management. My point is just to note that solutions are: 1. Attainable, 2. Attainable primarily in the framework of socio-economically and technologically well-developed societies. In poor and under-developed societies waste hauling and disposal is an important problem.

7. Education, Healthcare and other areas of progress

Education is one of the main needs of the modern society. It is clearly easier to attain, even by relatively poor people or those living in remote areas, than ever in human history.

The internet and related technologies have brought the resources of major libraries and many publications to all areas of the Earth. A substantial proportion of those resources are available free of charge. We may lament disappearance of certain traditional forms of education, or bad organization of some schools, but, globally, thanks to the online resources, many level of education are less elitist and more accessible than ever, even at the level of course-notes from MIT and other top colleges as well as free online classes from Coursera, Khan Academy and other similar sources. (This is in stark contrast to the tendencies of established educational methods in the West, which do become more and more elitist, largely to the increase in the cost of higher education and also decline in quality of public schools outside of the opulent areas.) While the role of old-style universities, with professors as power centers, is quite clearly inefficient in higher education and creation of knowledge, new more horizontal forms, based on teams of experts, predominant in the leading research institutions, get most recent Nobel Prizes and attain many of the most innovative achievements for the last few decades.

It is important for healthcare to follow the trend of online education and to enhance access. Medical advice could be made much less expensive if it was partly automated the way many aspects of online education are. In fact, telemedicine is not being practices in the US and in many other areas of the world with the benefit to patients.

Most medications, especially those available for generic production, could also be made very cheap and accessible around the globe for the low price. There are always guilds of people who benefit from the *status quo* and invest their political resources in keeping it, at the cost to those who are excluded from the current model. Pharmaceutical companies, doctors and professors are only three of such groups. In some areas the changes allowed by the technology took place very easily. For instance investment bankers woke up one day and realized that most of their services have been replaced by automated investment-banking website with great benefit to smaller investors. Teacher unions, medical organizations and a few other guilds tend to resist change more efficiently and some of their causes are well justified but great systemic cost-cutting changes are coming also to those sectors and those can be beneficial to the patients. Despite the worries related to the so-called digital divide between the rich and the poor, which is actually a disappearing phenomenon, those changes are likely to benefit the worse off, most underserved members of the global community.

8. General population concerns

It is sometimes claimed that the increases in human population are bad for the environment even if there were indeed ways to deal with the shortages of energy, food, sweet water, housing, education and healthcare as well as excesses of waste and pollution. This is of course an echo of the thinking by Ehrlich, Harding and others who view the Earth as a life boat that is likely to reach its capacity sometime soon. So far, the argument has been that we are very capable of dealing with all of those shortages, and some of them no longer exist

[Naam, Simon]. This supports a claim that we are far away from reaching the carrying capacity of our planet.

A different line of argument tries to show that such carrying capacity is a myth. H. Simon argued that human ingenuity that comes from additional people who live under conditions of relative economic and socio-cultural freedom compensates for population growth and in fact enhances quality of living. We may add to this argument, that even if one though of Earth as having a limited carrying capacity for the numbers of human beings who could live here, having a much larger population than the one we have today would result in the opportunity of the investments needed for settling on other planets and perhaps in other solar systems – this is the conclusion drawn by Elon Musk, one of the biggest practical innovators of our times. Such opportunity, obviously expensive even for the future economy, would be unlikely to materialize on a scarcely populated Earth. While there is such a thing as the carrying capacity of the Earth, two things seem to run counter to the attempts to curb the population of our planet. First, it seems likely that even the technologies right on the horizon would allow for a much higher population than what we have now. Second, building colonies on other planets should not be viewed as a far-fetched idea by any person with a naturalistic view on science and humankind.

For those readers who find the above comments as science-fiction let me close with some down to earth facts to the similar effect. The problem with current pension systems comes predominantly from the fact that there are not enough children that grow up able to pay for the more numerous older generations. Many aspects of the current economic slowdown in the West also come from the fact that rich societies do not have enough new members joining the workforce and creating the new demand. An old idea that there is a structural (or, systemic) unemployment that would characterize future economy is mostly a way to justify persistent unemployment for political elites in inefficient economies, predominantly in Spain. The true structural unemployment comes from the lack of workforce mobility both geographic and also the mobility in terms of adaptability to the new workforce needs (as well as from the elevated cost that comes from heavy regulation of various aspects of human resource management that increases the cost of hiring and firing employees). Finally, it comes from educational philosophy that fails to teach children, and their families, to follow the workforce needs: We all need computer engineers and plumbers, though the number of jobs for designers and performing artists may indeed be quite limited. Over-stability of various levels of expectations and the lack of flexibility of accepting temporary low paying starter jobs also comes from an excessive safety net, but this is a topic for another article.

9. Global warming

Human activity, especially production and emission of the substances producing the greenhouse effect, undoubtedly is a major contributor to the process of global warming. A

long-term background process that further affects global temperatures is most likely a late stage of the last ice-age. Reduction of greenhouse gases should be taken very seriously. This process is nearly futile if undertaken merely in a few economies, e.g. the European Union. The only way to make this process global would require the West to exercise a strong, yet realistic pressure on the main pollutants, including but not limited to China. Such pressures must include a very strong prohibition and/or extra taxation of imports of any products such that any of their components were made in violation of the global environmental standards. Yet, it would also require the West to make environmentally friendly technologies available to China and other developing countries. Merely punitive measures would result in economic problems of unprecedented scale and not only political instability but also further environmental degradation characteristic of the poor regions. Harmonized international growth, and especially the use of advanced technologies, provides the main, but not the only component of combatting the greenhouse effect. Environmental innovation and research in environmentally friendly technologies is another step in the right direction.

The next step may be disappointing to some. Today 'resilient design' is becoming an important term. We need to develop resilient architecture, landscaping and transportation. As Peter Wenz, one of the leading environmental philosophers, claims it is unlikely that global warming can be avoided. The question is primarily whether the sea level would rise, globally, at the magnitude of 20 meters or 80 meters. This is an important battle to win, but we should not expect that there is going to be no effect of global warming – it is already happening. Most healthy environments as well as most economies are able to take up the challenge of some climate change. This should not suede us from working on the environmentally sound solutions. However, we should also work on the ways to survive, and even thrive, in the warmer environment, with heavy changes to the shorelines and more environmental unpredictability. This is especially important since human activity, even if it became environmentally neutral, would not reverse the earlier greenhouse effects or a much slower natural trend associated with the ending of the ice age. We need to develop resilient design, resilient economy and land management. In fact, we should work not just on survivability but 'thrivability' under the new environmental conditions. While working to slow-down and eventually reverse the global warming trends, we need to develop the technologies to thrive in this changing environment.

10. The warning against the natural economy

The Ancient Rome, the most successful state in the history of Europe, collapsed as a result of barbarian invasions that did not even reach many regions of this vast Empire. What destroyed the whole country, not just its regions directly affected by the most rampant excesses of the invaders, was the country's collapse into the so-called *natural economy.* Once the central government failed to the secure roads against common robbers and to place large

orders, trade nearly stopped. This led to the lack of large-scale or high-quality production, disappearance of the military and the collapse of education, art and culture. Some regions were able to sustain good, maybe even idyllic life for their citizens for a short period of time, but those dubious gains have proven unstable since generation after generation culture, art, science and general level of living decreased and eventually, after a couple of generations, the dark early Middle Ages reigned everywhere.

Some advocates of sustainable development – those who view it as stagnation or anti-development – seem to be advocating the move towards natural economy. Unfortunately, the consequences of the cultural and economic collapse and the invasion by the dark forces of political or religious fanaticism would be very likely to follow. I do not think that such outcomes are desirable in any way.

Part II. Environmental Epistemology

1. Competing epistemologies

The famous rabbit-duck picture – a picture that one can view as a rabbit or as a duck but not as both at the same time -- is the clearest example of *Gestalt* psychology. It is also discussed by Ludwig Wittgenstein in terms of its general importance for epistemology. Seeing and perceiving happens through human senses mustered and improved mostly in early childhood. Yet, some non-trivial epistemic aspects of our image of the world remain open-ended for the lifetime. The image of the world is never final but always up for epistemic reinterpretation (such reinterpretation seems akin to learning by neural networks). Oftentimes we are capable of seeing the same world-view in more than one way, which is exploited by marketing, religions, ideologies, and political manipulation.

I remember flying from Texas to NYC on a smaller plane a few years ago. With excellent visibility, it was easy to see every farm and group of trees on the ground. For some reason I started viewing the scene with an optic of radical environmentalism. I was pleased to see some pristine forests and deserts with only sparse roads or settlements, which I viewed as areas of *minimal human infestation*. Then there were villages surrounded by farms and sizable areas of what looked like the wild-life; I viewed this landscape as *moderate human infestation*. Then there were towns and urbanized areas with small houses on mid-size lots and what looked like clear lakes and rivers, although most green areas looked more like golf-courses and intensive farming enterprises than the wild-life. I viewed them as the areas of *medium human infestation*. Finally, New York City emerged with its colossal buildings, nearly all areas taken by heavy developments. I viewed them as big termite colonies, they were scary areas of *extreme human infestation*.

Then we came closer – I saw the Manhattan in all its glory, and modern beauty, not even moderated by poverty and dilapidation invisible at a distance – and, well, the optic has changed. Now I was proud of human developments, industrial growth, culture; I remembered Chagall's paintings in the Metropolitan Opera and so many other wanders of New York and other centers of civilization. I was glad not to live on a Texas desert, or in the Boundary Waters of Minnesota, infested with mosquitos, poison ivy, wild bears and what not. In the process of my trip I went through the whole epistemological spectrum available to human environmental attitudes, from radical environmentalism to the epistemology of radical civilizational growth. I faced the obvious questions: What is the way to choose among such different manners of seeing the world, **the rabbit and the duck of environmental epistemology**? Is there the right choice? Can we even choose among them?

Deep ecology can become anti-human when it views human beings as infestation, the way most people view the roaches and the termites. But it's opposite, radical progressive enthusiasm, may also get destructive when it blindly follows progress and profit to the detriment of the environments of superb value and irreplaceable beauty, leading to massive disappearance of species and to the pollution of air and water. Pol-Pot was an infamous representative of the excesses of the former kind. As a French-educated intellectual of the 1960s, he enforced the idea – that to some may even look *kind of* attractive, on paper – that nobody should be able to survive if they would not be able to do so in the jungle. People with prosthetic devices, even the eye glasses, were out of luck when deprived of them and thrown into the jungle. Population of large cities were sent to the jungle to their detriment, and temporarily also at the detriment of the jungle.

Excesses of the latter kind, related to environmental insensitivity and destruction, are easy to spot and often criticized by environmental activists, yet rarely condemned by the silent majority of the middle-class whose interests, watered down by advertising and political marketing, dominate social and political opinion of the industrialized world. This is because the same people who may, on occasion, be lamenting disappearance of Brazilian jungle are eager to buy angus beef raised on the lands developed after the jungle was burned; most of the same people who accuse everybody else of destroying the economies of Africa vote for farm subsidies in Europe and the US that are the single most important factor that destroys those agricultural economies; most of those who are perplexed by the poverty of workers in the so-called Third World countries lobby against outsourcing of what they view as the Western jobs, though such jobs, for the most part, provide superior employment opportunities and improve general working conditions in those poor countries. People tend to be idealistic when engaged in moralizing, at the level of ideological *superstructure*. Yet, nearly all of us are very pragmatic and business-minded (often also myopic) at the level of economic *base*, when faced with one's own livelihood.

Faced with such epistemic and moral characteristics of human nature, with our inherent partiality and opportunism, can we ever hope for a stable, morally justified, balanced environmental policy? Well, we have at least one important tool able to help us attain this goal: human ability to critically assess our goals and to evaluate pragmatic reasons to believe, reasons to adopt and evaluate certain goals, to ascribe to various epistemologies and even to adopt ideologies. Such critical clarity would be essential when we tackle the issues of sustainability and growth.

Methodological underpinnings

Human beings, and almost[5] all animals, can be viewed as deeply interactive cognitive architectures implemented in biological matter through the evolutionary process. Human specificity among the animals – if any – consists in theoretical thinking.

Human thinking is theory laden in several ways. Scientific thought depends on paradigms, or a broad context of predominant theories at a given time. Social thought depends on various social conventions and norms that guide not only inter-personal behavior but also interactions. Those paradigms influence human epistemology, which teaches us what we should or should not perceive to build the image of the world. Value-based thought puts further focus upon emotive and axiological elements of our choices. It is worth noting that all human activity, even the most detached engineering work, is value-driven in a broad sense (this involves moral values as well as individual and institutional aims and goals); such is the structure of human motivation and thought (and, at a pragmatic level, of the funding of science). Those general observations have practical implications and applications.

What does it mean that human beings are **deeply interactive**? Not only do we interact with the external world (and also with our internal milieu) but we are also shaped by such interactions in the most profound ways. The clearest instance of how deep such interactions reach into what we would ordinarily consider to be *the human nature* are the so-called feral children – human infants that by some luck have been raised by animals. Those children, investigated primarily in the 1700s to the early 1900s when such instances were more likely to occur, exhibit behavioral, psycho-motoric and cognitive features specific of the animals they grew among. They develop unusual abilities to use smell, if raised among dogs, or tree climbing if raised among monkeys or apes. The most amazing, though sparely documented, was an instance of motoric skills, including four limb locomotion and high-jumping, developed by a child raised by a herd of wild goats. A similar mechanism of adaptation is known in human beings that live in highly unusual conditions in our society. Children who grew up in the old circus communities developed skills rarely mustered by humans, and at an early age at that! The same goes for children immersed by their care-givers into horse-riding, deep sea diving and other physical as well as intellectual activities. Also persons with

[5] Some animals are not deeply interactive due to devolving into a plant niche.

disabilities develop their special skills, for instance those blind from childhood compensate with the sense of hearing and even develop some skills in echolocation (mustered so well by bats and birds).

Those behavioral observations are consistent with human developmental neurobiology: we are born with large numbers of neurons that are an order of magnitude more numerous than what we end up with at an adult age. While some scientists may view this overabundance of neurons in infant brains as a waste, or, to the contrary, their eventual reduction as an early stage of the aging process with its potentially detrimental consequences to human intelligence – the best explanation seems neither. We are born with the abundance of neurons so as to be open to the large variety of interactions that would eventually shape details of our cognitive architecture; the large number of neurons indicates the potential for radically different cognitive architectures that reach far beyond the lives of what we consider civilized human beings.

What does it mean that **human thought is theory-laden and, indirectly, value-laden**? Thought is an evolutionary adaptation, like nearly every stable feature in biological systems. Theoretical and social constructs, such as civilizations, cultures, scientific paradigms, applied ethical views and legal frameworks provide more than the so-called *superstructure* over the *base* of some hard reality (whether one views such reality as genetic, socio-economic or another level of human existence). Specific social conditions are essential to evolutionary success. While some of the Marxist philosophers would view such interaction as a complementarity relation between dialectical and historical materialism, there is a better, clearer way to grasp this process consistent with evolutionary biology. Individual organisms tend towards homeostasis, which is often subjectively felt as well-being [Damasio], but only those organisms characterized by evolutionary fitness are stable in a longitudinal, multi-generational way. The idea, quite commonly taught in high schools all over the world, which says that evolution stops where civilization begins is patently false and scientifically quite non-understandable. To the contrary, civilization is one more evolutionary adaptation that exercises its evolutionary pressure back, thereby producing specific adaptability conditions. It defines what is truly relevant for human fitness in the human – now civilized – world. Just like wolves and berries in the forest were truly real (in the Hegelian sense) for human hunter-gatherers since our survival depended on them to some non-trivial extent, civilizations with their economies, cultures, social status, jails, schools – and yes, ideas – are the true conditions of evolutionary fitness for human beings today. For instance, as a consequence of WWII, in Poland alone, about 4 million of citizens of Jewish background, over 3 million of Polish ethnicity, and about 1 million of German nationals who used to live in today's territory of Poland were killed (for the Jewish population it amounts to over 90% of the original numbers). By all evolutionary standards this rivals and surpasses 'natural' disasters including famines and epidemics. Ideologies provide evolutionary pressures that are even easier to

underestimate. By many standards, Polish intelligentsia (of non-Jewish ethnicity, since the latter has suffered a loss of even higher proportion) may have lost about 50% of its numbers during WWII, especially among males. However, it is more difficult to estimate the losses to the same social group – younger generation with the roots in pre-WWII Polish intelligentsia – in the next generation, in the 1950s and 1960s. A conservative guess is that they have lost over 50% of their post WWII numbers due to the lack of children, which may be ascribed partly to socio-economic pressures and repressions under Stalinism, but to a large degree to the influence of Sartre-style early liberalism that attached little value to children and family (the latter is common with Western intellectuals). Intergenerational population decline among the intellectuals in the West can be traced in part to ideology of *overpopulated Earth* developed in the 1960s and 1970s by Ehrlich, Harding and others that we discussed in the previous section. If true, this is another eye-opening example of the role that social pressures and even ideologies play in human evolutionary transformations in the historic, and maybe recent pre-historic, era. Epistemology as an ideology has tangible implications on human evolutionary history.

2. Humanism in the Balance

I want to ride my bicycle – ideas on sustainability

If I ride a bicycle it is important to keep my balance. It is very hard, even dangerous, to ride very slowly; it is also difficult and often unsafe to ride very fast. The instinct that it is prudent to do things at a low speed, and altitude, fails in many situations. There is an old joke, a mother of a recently minted airplane pilot says: *My son, make sure to fly slow and at low altitudes.* Oh well, this is one of the most dangerous things a pilot can do. Technological and economic development is like riding a bicycle or flying an airplane – it may be dangerous to move overly fast but it is also very dangerous to move slowly, not to advance at all or to regress. I pose that this is true also of environmental damage; economic regress, stagnation or low level of progress result in environmental risks. Clearly, rapid growth that is out of control is also an environmental danger. Hence, sustainable development should be understood as true economic, technological and civilizational growth, though the exact speed that makes it most sustainable (environmentally, as well as by broad socio-economic standards) depends on multiple factors.

This is not what most people who argue in favor of sustainable development have in mind. Many people view the so-called sustainable development as no growth at all. They think that in order to save the Earth we need to de-develop, learn how to live in more primitive Spartan conditions or to limit the numbers of human beings as well as to curb consumerism and technological progress. However, data show that those societies that are economically underdeveloped or use outdated industrial technology cause more environmental damage than the ones that use advanced technologies.

Remember the epistemology that views human civilization as ‘infestation’ of the Earth that I experienced briefly on my airplane trip? Such deeply anti-humanistic epistemology, if endorsed, would lead, in practice, to inhumane policy. The charges of human chauvinism may sometimes be justified when human beings disregard the value of the natural world. However, some level of partiality, at least partiality to human beings, is more and more accepted in moral theory [Scheffler] and it looks like a necessary component of humanism. Environmental values may have inherent worth, for instance the cause of saving the pandas or even some deep see fish that few people know much about, but their core seems to be grounded – justifiably so – in human needs for clean air, water, environmental balance as well as bio-diversity[6]. There are kind and nice versions of ethical theory that give equal value to humans and non-human entities, such as Leopold’s Earth ethics (essential to deep ecology) and Floridi’s ethics of information – yet, those approaches always already question the fundamental value of humanism. Should our environmental policy put the main core of humanism into question?

Human Flourishing

The whole edifice of value that has been guiding human civilization for thousands of generations, as documented in literature, religion and ethics, relies upon the fundament of the value of human flourishing and growth. The *Genesis*, in one of the passages central to the Judeo-Christian tradition, contains a command to *multiply, fill the Earth and make it one’s own [in some translations ‘to make the Earth subservient to man’, but even a more neutral translation conveys the main message]*. This approach is the gist of humanism, both religious and secular. There is a certain value in human life that, *prima facie*, is valued more highly than other objects in animated or inanimate nature. There is also value in multiplying and bettering human life, which includes both intellectual-spiritual and technological betterment. Those are the tenets of practical humanism. Those tenets justify why we value the work of a doctor; why in emergency situations we ought to save human lives, and why we should to be benevolent to other human beings. A civilization without those shared basic tenets of humanism, would be very different and potentially quite inhumane.

Concluding remarks

Sustainable development is often interpreted in popular culture as no development at all. I hope to have demonstrated that this is a misconception. Human civilization is most sustainable when it enjoys technological and economic growth. It becomes un-balanced and unsustainable under conditions of poverty and civilizational regress. Just like it is easier to ride a bicycle with full speed than at a very slow pace, also overly slow development puts

[6] Biodiversity is a resource in many ways since we learn how to use different organism; specifically, it is a resource for bio-engineering (though bio-engineering and genetic engineering have got some bad wrap in the EU).

societies off balance in socio-economic terms: there is low demand for products and services, little research and development, science stagnates (which leads to development and eventual predominance of various unscientific ideologies). Even the pension funds do not have enough contributions to pay those already in the system since the new generation is not rich enough and not numerous enough to contribute. On the other hand, overly fast unchecked growth may also cause harm. Hence, sustainable growth involves a balanced approach between too much and too little development, though, since error is an unavoidable feature of human activity, it looks like a good idea to err a little on the side of progress.

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Omówienie

Zrównoważony rozwój powinien być zdefiniowany jako poziom rozwoju, który może być w utrzymany na długą metę. W normalnych warunkach zrównoważony rozwój implikuje pewien rozwój; jakie tempo rozwoju jest odpowiednie zależy od czynników takich jak środowisko naturalne, sytuacja ekonomiczna i inne. Ehrlich i inni twierdzili w latach 1960ych, że znajdujemy się w sytuacji braków i skrajnego wyczerpania zasobów naturalnych, która wymaga redukcji a nie rozwoju. Autor tego artykułu przyznaje, iż cywilizacja napotyka w pewnych obszarach ekstremalne wyzwania ekologiczne, zwłaszcza w sferze globalnego ocieplenia. Jednakże centralne dla teorii Ehrlicha hipotezy, że czekają nas znaczące braki surowcowe oraz zmniejszenie produkcji żywności jeszcze przed rokiem 2000, nie sprawdziły się. Zatem świat aktualny podąża po innej trajektorii niż scenariusz obmyślony przez Ehrlicha. Znajdujemy się w pozycji by usunąć wąskie gardła w rozwoju cywilizacyjnym, takie jak braki wody pitnej i energii, dzięki użyciu czystych technologii. Znajdowalibyśmy się w gorszej sytuacji gdybyśmy mieli zmierzyć się z podobnymi wyzwaniami w warunkach ekonomicznej stagnacji i zapaści demograficznej. Największym wyzwaniem ze strony środowiska naturalnego jest obecnie globalne ocieplenie. Jednak nawet w tej sferze mamy większe szanse by zwolnić a w końcu odwrócić trend wzrostu poziomu gazów cieplarnianych w warunkach wzrostu ekonomicznego opartego o zielone technologie niż bylibyśmy w sytuacji cofnięcia się do jakiejś ekonomii naturalnej. Zmierzenie się z globalnym ociepleniem wymaga znacznie silniejszej polityki ekologicznej w skali globalnej, co włącza międzynarodowe dzielenie się technologiami przyjaznymi środowisku, a w ślad za tym jednolitego egzekwowania norm zanieczyszczenia. Ponieważ za późno jest na to byśmy uniknęli wszystkich skutków globalnego ocieplenia, technologicznie i ekonomicznie silna ludzka wspólnota jest również w lepszej pozycji by zwiększyć odporność na jego skutki, począwszy od architektury i inżynierii lądowej a skończywszy na rolnictwie i architekturze zieleni. Sugestie Ehrlicha, które prowadzą do cofnięcia się do gospodarki naturalnej, mogłyby stanowić dobrą radę dla jakiejś innej, mniej technologicznie rozwiniętej, mniej progresywnej cywilizacji jednak fakty empiryczne sugerują, że Elon Musk, wizjoner z Tesli, próbujący ‘zachować ludzką świadomość’ za pomocą zaawansowanej technologii reprezentuje bardziej współczesną wersję enwironmentalizmu.