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2052 – A GLOBAL FORECAST FOR THE NEXT FORTY YEARS

A 5.000 WORD SUMMARY

Jorgen Randers¹

2052 – A Global Forecast for the Next Forty Years argues that global population and GDP growth over the next forty years will be slower than most expect, but not slow enough to avoid greenhouse gas emissions that will push the average global temperature above the internationally agreed danger threshold of plus 2 degrees Centigrade over preindustrial times. This will cause reduced well-being, especially in the rich world, but no *global* collapse by 2052.

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The question in 1972: Can growth continue?

In 1972 *The Limits to Growth*² report to the Club of Rome raised the question about whether growth can continue indefinitely on our finite planet. The book presented 12 scenarios for the world future to 2100. Six were negative – portraying various types of “collapse”, and six were positive – portraying various degrees of “sustainable development”. But *The Limits to Growth* (*LTG*) was unable to tell which of the scenarios was the most likely, simply because there was not enough information available in 1972.

This lack of information constrained *LTG* to the following main messages:

- a) *The world is small.* The human ecological footprint cannot continue to grow forever, and actually, the planet is so small that growth will stop within 100 years.
- b) *There is danger of overshoot.* The major systems of governance (capitalism and democracy) will prove unable to stop growth before the human footprint exceeds the carrying capacity of the planet. Global society will react too late. Overshoot will occur. And once in overshoot, contraction (in the form of managed decline or chaotic collapse) to sustainable modes of operation will be unavoidable.

In summary, the message of *LTG* was the following: Because of delays in global decision making, humanity will allow its footprint – its population and economy – to grow beyond the levels that can be sustained in the long run on small planet Earth.

The reaction to *LTG* was hostile rejection. People (at the time) did not believe humanity would be so stupid as to allow growth to proceed to unsustainable levels. Hence the threat of subsequent contraction – and especially the idea of “collapse” – was deemed as irrelevant.

The answer in 2012: Global society has overshoot planetary limits

² Donella H Meadows/Dennis L Meadows/Jorgen Randers/William W Behrens, *The Limits to Growth*, Universe Books, New York, 1972

Today – 40 years later – we know better. We know that growth has continued unremittingly. Both in the global population, the world economy (GDP), and the human footprint. More surprisingly, we know that global society has overshoot planetary limits. We do already live in a manner that can not be continued for generations without major problems emerging. The simplest proof is in the climate area. Annual human emissions of CO₂ are roughly twice as big as what is absorbed annually in the world's forests and oceans. As a consequence CO₂ is accumulating in the atmosphere and the global average temperature is increasing. The temperature increase is driving a number of changes that will make life more difficult for future generations.

Notice that the current overshoot is in fact the result of slow global decision making. Global society established the UN Intergovernmental Panel on Climate Change (IPCC) already 25 years ago, and had we listened to its advice, we would already be well under way in our effort to reduce greenhouse gas emissions. It is both technically feasible and surprisingly cheap to reduce emissions. All it takes is a shift of 1 – 2 % of the labour force and invested capital from “dirty” to “clean” activity. For example, instructing builders of fossil cars to produce electric cars, instructing energy companies to build windmills or gas-fired utilities rather than coal fired ones, and so on. The drop in after-tax income and consumption would be limited.

Instead we have spent 25 years in fruitless international negotiations, with little impact on global emissions. They have continued to grow, notwithstanding the fact that emissions obviously exceeded sustainable levels many decades ago. Unbelievably, human CO₂ emissions grew faster in the first decade of the 21st century than during any earlier decade!

2052 - A global forecast for the next forty years

So, we know what happened during the first forty years of the *LTG* scenarios. What will happen during the next forty years? My own answer to this question is described in the book *2052 – A Global Forecast for the Next Forty Years*³, which I wrote in 2012 as a report to Club of Rome. All detail is freely available at the book website www.2052.info.

The starting point is that we know much more today about the world and its future than in 1972. Hence it is meaningful to leave the safe territory of scenario analysis and instead make

³ Jorgen Randers, *2052 – A Global Forecast for the Next Forty Years*, Chelsea Green, Vermont, 2012

a forecast – an educated, well-informed, internally consistent, guess about what will actually happen from 2012 to 2052. Such a forecast is not a picture of what ought to happen, it tells what is most likely to happen. The uncertainty band around the forecast is of course wide, but not so wide that it makes the forecast devoid of content.

The 2052 forecast is the sum of individual forecasts I made for five regions. The regions are 1) the US, 2) the rest of the industrialised world, 3) China, 4) the 14 largest emerging economies, and 5) the rest of the world (some 140 countries). The forecast is based on the general world view represented in the most recent World3 computer model of the *LTG* study. It is also based on the assumption that technology will advance at the same rate as during the last forty years. And that there will be no change in fundamental values and preferences: society will continue to pursue income growth. There will be one important change, however. Over the coming decades global society will be facing a strengthening barrage of problems: depletion, pollution, climate change, inequity, social strife etc. I assume these problems will finally be met with increasing investment in solutions. But not *before* the problems become intense, only afterwards, when repair costs are unavoidable. To illustrate, I don't expect that the US will spend serious money up-front to reduce climate gas emissions, but the US can not avoid the cost of repair once hurricanes hit its cities or remaining gas becomes less accessible. In more general terms, nations will only react once there is convincing evidence of damage. Only then will money be spent to reduce the negative effects of depletion, pollution, climate change, and inequity. Only then will there be significant invest in adaptation. To repeat, this will not happen ahead of time, only after long, democratic delays for clarification and debate.

The 2052 Forecast: Slower growth, but enough growth to cause climate crisis

This section describes the logical backbone of the 2052 forecast. In summary 2052 says that global growth will slow – but not fast enough to avoid a climate crisis in the middle of the 21st century. This is sad, given that it is technically simple and reasonably cheap to solve the climate problem, and will result from excessive short-termism in human decision making. Global society will choose *not* to act in time.

Population

Let us start with the 2052 population forecast: The global population will peak at some 8 billion people around 2040. This is much below the standard UN forecast, and the reason is a continuing fall in gross fertility, that is in the number of children per woman during her

reproductive age. Not only will rich women increasingly choose a job rather than more children. In the expanding megacities of the developing world poor families will choose to have fewer children because of the high cost of rearing them in the urban environment. In sum, the global population will be declining in 2052, in spite of the higher life expectancy following from advances in medicine.

GDP

GDP growth will also slow. The global GDP equals the production of goods and services in the world economy per year. It can be calculated as labour force multiplied with productivity. The labour force will follow the population: it will peak and be in decline in 2052.

Productivity growth will also slow. This is because it will prove difficult to raise productivity in “mature” economies where most people work in personal services and social care.

Productivity growth was much simpler in agriculture, manufacturing, and office work. The slowing of productivity growth is easily observable in statistics for the US: it has declined from some 3 % per year fifty years ago to 1 today.

The slow-down in the leading economies does not preclude rapid growth in emerging economies when they catch up with the leaders, as Japan and Korea did before 2000 and China is doing now. Thus growth in the emerging economies will add significantly to world GDP towards 2052. But growth will be held back because many poor countries will not succeed in organising economic take-off.

Resource use

The slower growth will lead to a smaller population and a lower GDP in 2052 than many expect. This will mean continuing poverty. But it also will mean lower demand for resources. The use of resources will grow, but stay within the carrying capacity of the planet. The non-energy ecological footprint will stay within world’s biocapacity. Concretely, I do not foresee shortages of resources or food before 2052. There will be enough to satisfy demand. But note that this is not the same as satisfying need. There will be many poor in 2052 unable to pay the price for food necessary to lure farmers with excess land (in Brasil, Ukraina and Russia) to increase their production. Thus, there will be starvation during the next forty years for the same reason as during the last forty: inequitable income distribution. Starvation will not be the result of physical limitations on the planet’s ability to produce food.

Energy

Once we know future GDP and assume that technological advance in energy efficiency (i.e. energy use per unit of GDP) will continue as in the past, it is simple to calculate future energy use through multiplication. The result is that global energy use will peak in around 2040, and then decline. After 2040 the use of power, heat and fuels will decline year on year, because efficiency growth will supersede GDP growth.

CO2

Over the next forty years the shift towards less carbon-intensive energy sources will continue and accelerate when global society gets increasingly worried about climate change. I forecast that 40 % of the world's energy in 2052 will be supplied from hydro, wind, solar and biomass.

That still leaves 60 % fossil energy in 2052, and sadly the same annual CO2 emissions as today. Global CO2 emissions will grow to a peak around 2030 and then decline back to current levels by 2050, and continue thereafter. This is a far cry from the current ambition level in international climate negotiations, which is a reduction of 50-80 % by 2050.

Temperature

Given my forecast of global CO2 emissions it is possible to calculate future temperatures using the big modern climate models. They say that my forecast will lead to a global average temperature increase (over preindustrial times) of plus 2 degrees Centigrade by 2052, and touch +3°C around 2080. This means that global society will blast through the danger threshold of +2°C (agreed in Durban) already forty years from now. This means that we will experience more frequent extreme weather events in the decades to come, and possible see self-reinforcing climate change in the second half of the 21st century. The warmer weather will melt more tundra, which will emit its CO2 and CH4, which will in turn make it even hotter, melt more tundra, and so on until all tundra is melted and the average temperature is much higher. This will take time, but our grand children will not thank us for our current inaction.

Huge regional differences

But conditions will vary greatly. The rich world will be surprisingly hard hit. They will hardly see growth in after-tax disposable income over the next forty years, and the average US citizen is likely to see his take-home pay decline by some 10 % by 2052. Much like auto-

workers in Detroit have seen their real incomes erode over the last twenty years. The reasons for the decline will be slowing productivity growth in mature economies; sinking capacity for quick decision making (particularly in the US); and the need to repay foreign debt (particularly the US debt to China).

China on the other hand will experience tremendous growth. Per capita after-tax income will grow fivefold, through catch-up of rich world practices. The process will proceed smoothly because of perfect alignment between the interests of the materialistic Chinese to become rich and the interests of their strong government in rapid GDP growth to retain power. Rapid, forward-looking, and forceful decision making will help. Naturally, China's growth rate will decline when incomes rise, but in 2052 the average Chinese will be nearly as rich as the average European.

Some of the 14 big emerging economies will do well and follow the path explored by China. But others will fail in their effort to take off. Average per capita after-tax income will grow threefold.

Finally, the rest of the world will only manage to match historical growth rates, which means a doubling of per capita income in forty years. The rest of the world will, in other words, remain poor because of its low starting point.

The root cause: Short-termism in the rich world

In the 2052 forecast, the growth of population and GDP slow, but CO2 emissions continue and finally trigger a rapid decline in human well-being in the second half of the 21st century. This resembles the second of the twelve scenarios of *LTG* – the “pollution crisis”, where population growth stops and then declines because of the effects of pollution on health and agriculture. Consumption ultimately collapses because of huge investments in an attempt to maintain resource flows and a clean environment.

But there are important differences. In 2052 population growth slows because of the voluntary choice of women to have fewer kids, not because of pollution damage. And the economy slows not because of lack of resources, but because nations are unable to maintain traditional rates of productivity growth when their economies mature. After-tax income also takes a hit

because society must use an increasing share of the economic output to repair pollution damage. Weak governance and inequitable distribution aggravate the situation.

The climate crisis in 2052 could easily have been avoided, if the rich world decided to act. The crisis occurs essentially because rich society will not shift investments flows sufficiently fast - from traditional investments in carbon-intensive activities to modern investments in climate-friendly solutions. A shift from making fossil cars to making electric cars; from coal-burning utilities to wind-mills; from big un-insulated houses to small tight ones. An accumulated shift of 1 -2 % of the GDP would suffice. Not much, but hard to achieve in market democracies.

To solve the climate crisis, global society needs to shift investment flows from what is most profitable to what benefits society in the long run. Sadly, capitalism won't do this. Capitalism is made to allocate money to what is profitable, not to what society needs. Furthermore, democratic parliaments seem unable to pass the regulations that would align maximum profitability and the societal interest, Democratic parliaments do what the voters want, and most voters are against solutions that require higher taxes, more expensive gasoline, or higher electricity prices in the short term.

Sadly, global society has chosen two inadequate system of governance. Capitalism and democracy both focus excessively on the short term effects. Short-termism is the root cause of the climate crisis in 2052. We are unwilling to make a sacrifice today in order to better the lives of our grand-children.

Global society in mid-21st century

Global society in 2052 will be much smaller than most people think. The human economy will be twice that of today, not four times bigger which would result if GDP continued to grow at the historical rate of 3,5 % per year. As a result there will be more poverty than most expect – both in the poor and rich world. After-tax incomes will be lower than most expect because an ever growing share of the nations' labour and capital will be used to repair climate damage, get access to more expensive resources; handle pollution problems; and provide security. All this repair work will boost the GDP and the number of jobs, therefore unemployment will not rise to unbearable levels as long as there is sufficient solidarity in the nation to split the work. But more income will be required to pay for repair work – most likely

in the form of increased taxes that will pay for the investment work – and hence consumption will suffer.

The quality of life will be further reduced by an increasing frequency of climate events and other calamities. The natural world – untouched nature – will disappear, at least outside parks, as temperature zones move at 5 km per year towards the north pole (towards the south pole in the Southern hemisphere). People will be increasingly urbanized, and the life of the average citizen will be increasingly virtual. Formerly attractive destinations will be overrun and destroyed by hundreds of millions of tourists from the new middle class. Education, entertainment, travel experiences, social networking will be brought to the home as digital signals – in three dimensions, full colours, sound and smell. Little need – and opportunity – to move far.

Will this be the end of the world as we know it?

The end of capitalism?

No, I don't think so, in spite of my desire for a modification of “pure” capitalism through regulation and internalization of external costs. Sadly, the democratic majority will never go for a sufficiently high carbon tax to reduce emissions, nor rules that ban gas guzzlers or air travel for business and tourism. Some modification will occur, but not enough to call it the end of capitalism.

The end of economic growth?

Yes, global GDP growth will slow toward 2052, and peak sometime in the second half of the 21st century. Well-being may grow, but not the production of good and services. The average, per capita, after-tax income will start declining before 2052.

The end of slow democracy?

No, although I and many will call for stronger and more rapid decision making, we won't succeed because of the many conflicting interests in a modern, densely populated, and highly utilized world. The more democratic the society, the more special interest groups must be heard, and the longer it takes to make decisions on anything of importance to many people. This tendency is accentuated by higher education and income levels, and will contribute importantly to the slowing of the economic growth rate in mature economies.

The end of generational harmony?

Yes, the young will not take it for granted that they shall pay for the ample pensions we (the old) have promised ourselves. Nor the national debts we accrued to maintain consumption above domestic production. All while they can't afford a home like their parents. The young will simply leave the table. Pensions will not be paid in full. Debts will not be repaid, much will have to be written off. There is little pensioners and creditors can do about this in a democratic society where the majority rules. One may wonder how young Americans are going to treat their huge debt to the (young) Chinese – accumulated by their parents to help them consume what the old generation of Chinese set aside for a rainy day. I don't believe in wars over such issues, I believe in reshuffling of debt. But it won't leave much generational harmony.

The end of stable climate?

Yes, unless there is dramatic extraordinary action to reduce climate gas emissions during the next decades. Which I do not think will happen, because there will not occur climate events (“catastrophes”) of sufficient force to scare democratic society into action.

Five recommendations for global action

What could be done to avoid my sad forecast? Five recommendations stand out:

1) Slow population growth:

Have fewer children – especially in the rich world where each child has a high footprint.

Concretely this means to reduce the tacit, pro-natalist attitudes which still dominate modern societies, both rich and poor. More fundamentally, it amounts to welcoming women who choose a career rather than more children. It amounts to agreeing that caring for a larger number of old people is *not* best solved through immigration, but through an increase in the pension age. It amounts to understanding that when the fraction of old increases, the fraction of young declines, so the total “support burden” of young and old divided by those aged 15-65 actually stays relatively constant throughout. The working age groups will have to care for the old – not in addition to, but instead of, caring for the young.

2) Reduce the ecological footprint:

Eliminate greenhouse gas emissions from coal, oil and gas, first in the rich world

The simplest approach would be to ban the use of coal, oil and gas in rich countries. One practical way would be to introduce a carbon tax of 100 euro per ton of CO₂ emitted and a border tax adjustment to reduce carbon leakage. (This would roughly treble the price of coal-based electricity from 5 to 15 eurocents per kWh, and make it more expensive than many renewable energy sources.)

But it is politically impossible to introduce a high carbon tax because voters resist the resulting jump in the energy bill in the short run. Thus reducing the footprint amounts to gaining public acceptance for a small sacrifice today in order to create a better life for our grandchildren. It amounts to making voters accept slightly higher living costs. It amounts to obtaining political support for deliberate slowing of consumption growth in order to give room for more growth in long term investment.

3) Help the poor with clean energy:

Construct a modern low-carbon energy system in the poor world, paid for by the rich world. Concretely this means that the rich world would take the initiative, obtain agreement with the recipient countries, and pay for a climate-friendly energy system in the poor world. The energy system would be based on sustainable hydro, wind, solar and biomass resources, and most likely supplemented with carbon capture and storage retrofits on utilities burning fossil fuels. This energy system would both reduce climate emissions and suffering.

At the more fundamental level this recommendation amounts to obtaining political support for a reorientation of existing funds for development assistance.

4) Temper short-termism:

Establish supra-national institutions to help nations adopt policy that help our grandchildren. Concretely this means to delegate the authority to decide on certain matters to wise, quick and powerful entities which are beyond the day-to-day control of national parliaments and their voters.

There is a good model in the central banks that exist in most civilized countries and decide on the size of the money supply without frequent democratic interference. A “Global Central Bank for Climate” authorized to decide on the maximum greenhouse gas emissions for each

member nation, and providing advice (and preferably finance) to achieve the cuts, might do the trick. It could be built on the shoulders of the IPCC.

At the deepest level, this proposal amounts to gaining acceptance in the population for the benefits of strong government in situations where a problem is better solved by a supernational institution than by market democracy.

5) Establish new goals for rich society:

Pursue increased well-being in a world without growth.

Once beyond a certain threshold, increased income does not lead to increased well-being. At least when you haven't anyone to compare with. But there is always the neighbour or friend who gets a raise and triggers your desire/need for higher income – irrespective of how rich you were in the first place. This vicious circle could be broken by banning future income raise, and concentrating social attention on increasing your well-being within the limitations of a fixed annual income. This shift from growth in income to growth in well-being will make even more sense in the future when per capita income will remain stable in spite of the rich countries continuing attempts to achieve growth.

But I don't think we will see democratic decisions to stop income growth. Slightly less improbable is a future decision to reduce the number of hours worked per year. A shorter work year could be sold as a gradual increase in the number of vacation days (replacing the gradual increase in wages). This would reduce income growth, and motivate for further focus on increased well-being – which is natural when people have more free time and less money.

This amounts to convincing the majority of something that most middle and upper class people already know (but do not follow) namely that more money does not make you happier.

Will the rich world follow these five recommendations? I don't think so. At least not beyond the level assumed in the 2052 forecast. Capitalism and democracy will prevail more or less as is, and respond to global problems once they have occurred, not up front. And when responding, focus on what is cheapest in the short run.

Will we experience “global collapse”?

First, what is collapse? I define it here as “An unwilling, unstoppable drop in societal well-being”. I use the word “drop”, because the decline in well-being will stop once the counterforces grow strong enough. So collapse is a drop from one level of well-being to a lower one.

2052 forecasts a decline in well-being before the middle of the century – in most regions. Disposable income will stagnate or decline, increasingly erratic weather will cause problems, and so will distributional inequity and social tension. The natural and cultural environment will be increasingly damaged and provide ever less comfort.

I believe the next forty years will resemble the run up to the “pollution collapse” in *LTG* scenario 2. Life will become increasingly less attractive as a result of the warmer and more variable weather, but with huge regional differences – in some regions the new problems will be masked by rapid income growth. Social tension, unrest and regional wars will exist – much like today and for the same reasons – and be accentuated by climate migration. I don’t believe these regional conflicts will evolve into global wars that stop the world. The situation will be like today, when the wars in Afghanistan and Syria do not disrupt daily life elsewhere.

But there will be a widespread feeling of crisis – resulting from a gap between expectation and reality. This sense of impending disaster will be somewhat softened, however, because of sporadic progress in the form of successful adaptation: dikes that actually do keep the rising ocean out, storm sewers that actually do handle extreme rain, new plant species that do grow in spite of more frequent drought. Such successes will generate hope for a better future. People will also get used to the welfare loss (i.e. the higher prices) that will arise from emerging protectionist trade restrictions. And finally people will increasingly accept virtual reality as a substitute for the real thing – for real tourism, live entertainment, physical meetings and school classes.

Finally, the exploding inequity in the distribution of jobs and income will be checked – through peaceful (and some cases violent) means. I don’t think the underprivileged classes in the rich world will accept continuation of current trends for very much longer. They will act and defuse this potential bomb through forced redistribution.

In sum I don’t think the next forty years will feel like *global* collapse, because all the effects mentioned above will reduce public opposition to what will be going on. But some unlucky

regions may collapse, and the prospect for the world in the second half of the century is less promising.

Notice that, other analysts are more pessimistic. They believe that the globally interconnected system is more unstable than I think. One reason for my optimism is that I think the rich world will prove surprisingly willing to accept welfare loss, as long as it strikes all. When certain goods and services are no longer available it is a crisis in economic terms, but not in reality. Most people simply get used to not having these goods and services at hand. Full crisis only occurs when the poor can no longer afford minimum food, clothing and shelter. But the poor world is used to losing out and cannot do much about it.

No *global* collapse by 2052

Thus, in 2052 some people (today's elite) will argue that their world has collapsed or at least lost its brilliance. Others (the new and old middle class) will argue that their world is about to collapse. Another big group (including many Chinese) will argue that the last forty years have been very good and expect continued progress. And many poor will argue that their small income raise since 2012 has been counterbalanced by new problems in other dimensions.

An external judge – looking at world statistical averages – will see a global society with a shrinking population; stagnant after-tax per capita income; increasing climate damage; much unavoidable public spending on adaptation; and un-reassuring answers to the question: “On a scale from 1 to 10, how satisfied are you today?”

In summary: Only current elites will see the next 40 years as collapse. Much of the current middle class will have seen erosion of their well-being. But huge adaptation efforts will be in swing and provide some hope. Regardless, most will be worrying about things getting worse in the second half of the century.

Help make the 2052 forecast come untrue

Obviously, I don't like what I see in my global forecast. A much better future is technically possible and not impossibly expensive. But to get there will require decisions that are unlikely emerge in market democracies. Luckily the 2052 forecast is a cliff hanger, in the sense that a small amount of extra effort would do a lot of good and help us avoid this sad future. This

gives motivation for continuing the struggle for a better world. And hopefully make my forecast wrong.