

## How Sustainable is the World as a System?

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Corporate sustainability, social responsibility and sustainability in general are trendy subjects nowadays. There exist numerous programmes, institutes and research centers dedicated to the subject of sustainability. One aspect such initiatives have in common is that they don't provide measures of sustainability.

On some occasions an index or a score is defined, whereby experts in different fields provide opinions which are then combined into a single indicator by means of subjective weights. These too are defined by experts. The goal is generally to define some sort of benchmark. Today, in a turbulent regime, this is not the best way to proceed. It is necessary to look beyond conventional linear thinking. In a globalized and turbulent economy it is necessary to resort to science, not to opinions of sensations.

In our recent blog we have proposed a proxy of sustainability. Here we elaborate on the subject and propose an actual measure thereof. The concept is simpler than one may think. As a system evolves (e.g. a growing economy, a society or a civilization) it becomes more complex and sophisticated. However, because of the laws of physics, this implies inevitable production of waste and disorder which are dumped into the environment as well as into the system itself. A process is sustainable, i.e. it can go on 'for ever', if:

- it has enough energy
- it doesn't drown in its own waste and the disorder it creates doesn't cripple it enough to cause non-governability or even collapse
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In the present blog we focus exclusively on the second issue. It is curious to note that in the WEF Global Risks Reports, for example, the major threats or global risks do not even mention 'disorder' and 'controllability'. There is no systemic dimension. Just a simple list:

- Fiscal crises in key economies
- Structurally high unemployment/underemployment
- Water crises
- Severe income disparity
- Failure of climate change mitigation and adaptation
- Greater incidence of extreme weather events (e.g. floods, storms, fires)
- Global governance failure
- Food crises
- Failure of a major financial mechanism/institution
- Profound political and social instability

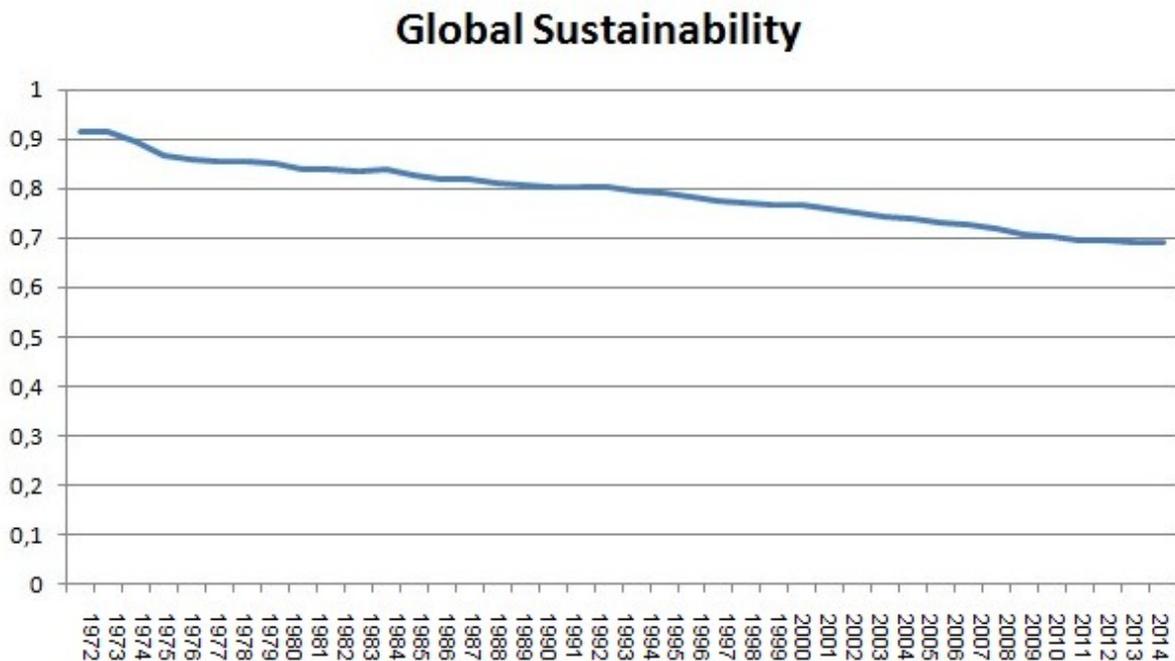
In general, these threats are simply pointed out and, sometimes, ranked, but very rarely quantified. And yet they all contribute to sustainability, or to its lack.

We define the following measure of sustainability, the Global Sustainability Measure:

$$S = e^{-\frac{E}{NC}}$$

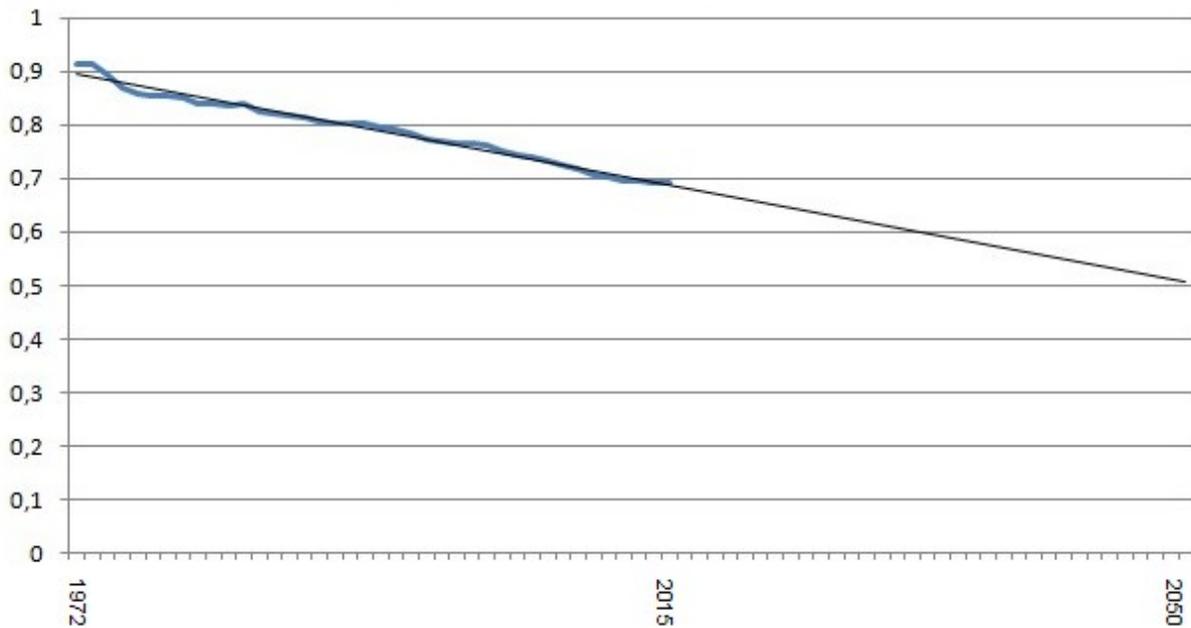
where E is entropy, C is complexity and N is the number of variables needed to describe a given system (the World in this case). The measure ranges from 0 to 1. Values close to 0 reflect systems dominated by disorder while values close to 1 point to highly structured and organized systems.

We have used the metric to process annual data published by the World Bank (we're talking of over a quarter of a million variables spanning 196 countries and hundreds of millions of correlations between the said variables). The result is as follows:



It is clear – and really not that surprising – that the World as a system is progressively becoming less sustainable. With our wasteful and decadent lifestyles this is to be expected. What is alarming is the fact that the Global Sustainability Measure (GSM) is diminishing at a steady rate. Since the early 1970s the drop is nearly 20%. There seems to be a slight reduction in the gradient over the past few years but this may be attributed to the 2008 meltdown which has slowed down everything, not just the economy, but also waste and disorder production. The overall tendency, nevertheless, is a steady reduction of the GSM.

But what is a critical value of the GSM? Given the current state of affairs, how much more can we stretch things? We will see global collapse at 0.6? Is, say, 0.5 a limit of implosion? Things are already looking pretty bad today, at just under 0.7. Projecting the above tendency it appears that the GSM could reach a value of around 0.5 by 2050. Providing the system doesn't begin to implode before then. Clearly, this is just a simple extrapolation.



The best way to know how things really are is to constantly monitor and measure and to confront the results with reality (not with models thereof). The GSM is of course just one number. However, it is most interesting to identify the main contributors to the GSM and to identify which countries are responsible for the rapid decline of global sustainability. The information is available in the form of the so-called Complexity Profile, which ranks all of the countries in terms of their impact on the GSM. This, however, is beyond the scope of this short blog.

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