# Nasa-funded study: industrial civilisation headed for 'irreversible collapse'?

Natural and social scientists develop new model of how 'perfect storm' of crises could unravel global system

This Nasa Earth Observatory image shows a storm system circling around an area of extreme low pressure in 2010, which many scientists attribute to climate change. Photograph: AFP/ Getty Images

A new study sponsored by Nasa's Goddard Space Flight Center has highlighted the prospect that global industrial civilisation could collapse in coming decades due to unsustainable resource exploitation and increasingly unequal wealth distribution.

Noting that warnings of 'collapse' are often seen to be fringe or controversial, the study attempts to make sense of compelling historical data showing that "the process of rise-and-collapse is actually a recurrent cycle found throughout history." Cases of severe civilisational disruption due to "precipitous collapse - often lasting centuries - have been quite common."

The research project is based on a new cross-disciplinary 'Human And Nature DYnamical' (HANDY) model, led by applied mathematician Safa Motesharrei of the US National Science Foundation-supported National Socio-Environmental Synthesis Center, in association with a team of natural and social scientists. The study based on the HANDY model has been accepted for publication in the peer-reviewed Elsevier journal, Ecological Economics.

It finds that according to the historical record even advanced, complex civilisations are susceptible to collapse, raising questions about the sustainability of modern civilisation:

"The fall of the Roman Empire, and the equally (if not more) advanced Han, Mauryan, and Gupta Empires, as well as so many advanced Mesopotamian Empires, are all testimony to the fact that advanced, sophisticated, complex, and creative civilizations can be both fragile and

impermanent."

By investigating the human-nature dynamics of these past cases of collapse, the project identifies the most salient interrelated factors which explain civilisational decline, and which may help determine the risk of collapse today: namely, Population, Climate, Water, Agriculture, and Energy.

These factors can lead to collapse when they converge to generate two crucial social features: "the stretching of resources due to the strain placed on the ecological carrying capacity"; and "the economic stratification of society into Elites [rich] and Masses (or "Commoners") [poor]" These social phenomena have played "a central role in the character or in the process of the collapse," in all such cases over "the last five thousand years."

Currently, high levels of economic stratification are linked directly to overconsumption of resources, with "Elites" based largely in industrialised countries responsible for both:

"... accumulated surplus is not evenly distributed throughout society, but rather has been controlled by an elite. The mass of the population, while producing the wealth, is only allocated a small portion of it by elites, usually at or just above subsistence levels."

The study challenges those who argue that technology will resolve these challenges by increasing efficiency:

"Technological change can raise the efficiency of resource use, but it also tends to raise both per capita resource consumption and the scale of resource extraction, so that, absent policy effects, the increases in consumption often compensate for the increased efficiency of resource use."

Productivity increases in agriculture and industry over the last two centuries has come from "increased (rather than decreased) resource throughput," despite dramatic efficiency gains over the same period.

Modelling a range of different scenarios, Motesharri and his colleagues conclude that under conditions "closely reflecting the reality of the world today... we find that collapse is difficult to avoid." In the first of these scenarios, civilisation:

".... appears to be on a sustainable path for quite a long time, but even using an optimal depletion rate and starting with a very small number of Elites, the Elites eventually consume too much, resulting in a famine among Commoners that eventually causes the collapse of society. It is important to note that this Type-L collapse is due to an inequality-induced famine that causes a loss of workers, rather than a collapse of Nature."

Another scenario focuses on the role of continued resource exploitation, finding that "with a larger depletion rate, the decline of the Commoners occurs faster, while the Elites are still thriving, but eventually the Commoners collapse completely, followed by the Elites."

In both scenarios, Elite wealth monopolies mean that they are buffered from the most "detrimental effects of the environmental collapse until much later than the Commoners", allowing them to "continue 'business as usual' despite the impending catastrophe." The same mechanism, they argue, could explain how "historical collapses were allowed to occur by elites who appear to be oblivious to the catastrophic trajectory (most clearly apparent in the Roman

and Mayan cases)."

Applying this lesson to our contemporary predicament, the study warns that:

"While some members of society might raise the alarm that the system is moving towards an impending collapse and therefore advocate structural changes to society in order to avoid it, Elites and their supporters, who opposed making these changes, could point to the long sustainable trajectory 'so far' in support of doing nothing."

However, the scientists point out that the worst-case scenarios are by no means inevitable, and suggest that appropriate policy and structural changes could avoid collapse, if not pave the way toward a more stable civilisation.

The two key solutions are to reduce economic inequality so as to ensure fairer distribution of resources, and to dramatically reduce resource consumption by relying on less intensive renewable resources and reducing population growth:

"Collapse can be avoided and population can reach equilibrium if the per capita rate of depletion of nature is reduced to a sustainable level, and if resources are distributed in a reasonably equitable fashion."

The NASA-funded HANDY model offers a highly credible wake-up call to governments, corporations and business - and consumers - to recognise that 'business as usual' cannot be sustained, and that policy and structural changes are required immediately.

Although the study is largely theoretical, a number of other more empirically-focused studies - by KPMG and the UK Government Office of Science for instance - have warned that the convergence of food, water and energy crises could create a 'perfect storm' within about fifteen years. But these 'business as usual' forecasts could be very conservative.

*Dr Nafeez Ahmed is executive director of the Institute for Policy Research & Development and author of A User's Guide to the Crisis of Civilisation: And How to Save It among other books. Follow him on Twitter @nafeezahmed*

# Civilisation Is Doomed Warns Safa Motesharri's Nasa-Funded Study

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Civilisation is almost inevitably doomed, a Nasa-funded study has found.

Human society is founded on a level of economic and environmental stability which almost certainly cannot be sustained, it said.

The study used simplified models of civilisation designed to experiment with the balance of resources and climate that creates stability - or not - in our world.

These theoretical models - designed to extrapolate from simple principles the future of our

industrialised world - ran into almost intractable problems.

Almost any model "closely reflecting the reality of the world today... we find that collapse is difficult to avoid", the report said.

Mathematician Safa Motesharri begins his report by stating that "the process of rise-and-collapse is actually a recurrent cycle found throughout history" and that this is borne out by maths, as well as historiography.

"The fall of the Roman Empire, and the equally (if not more) advanced Han, Mauryan, and Gupta Empires, as well as so many advanced Mesopotamian Empires, are all testimony to the fact that advanced, sophisticated, complex, and creative civilizations can be both fragile and impermanent."

*Above: civilisations have risen and fallen throughout history*

His research - funded by Nasa's Goddard Space Flight Center and published int he Ecological Economics journal - explored the pressures that can lead to a collapse in civilisation.

These criteria include changes in population, climate change and natural disasters. Access to water, agriculture, and energy are also factors.

Motesharri found that problems with each of these is far more damaging when experienced in combination with another. When this occurs the result is often an "economic stratification" and "stretching of resources" which drags at society's foundations.

Under this highly simplified model, our society appears to be doomed.

In one of his simulations:

"[Ours] appears to be on a sustainable path for quite a long time, but even using an optimal depletion rate and starting with a very small number of Elites, the Elites eventually consume too much, resulting in a famine among Commoners that eventually causes the collapse of society. It is important to note that this Type-L collapse is due to an inequality-induced famine that causes a loss of workers, rather than a collapse of Nature"
He added that elites tend to have a vested interest in sustaining the current model - however doomed - for as long as possible, regardless of the eventual negative outcome:

"While some members of society might raise the alarm that the system is moving towards an impending collapse and therefore advocate structural changes to society in order to avoid it, Elites and their supporters, who opposed making these changes, could point to the long sustainable trajectory 'so far' in support of doing nothing."
There are caveats, of course. The study is a simplified model of society, not a perfect simulation, and it isn't able to make solid predictions of the future. It's also worth noting that Motesharri does allow for the possibility that "collapse can be avoided" - though he thinks it

will be exceptionally difficult.

Indeed, as the Guardian reports, other studies by the UK Government and KPMG have also warned of a "perfect storm" of energy scarcity and economy fragility coming within a few decades, which lends weight to his conclusion.

Oh, and then there are the robots.

# Collapse of civilisation is coming - Nasa study

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The end of modern civilisation is coming, according to a Nasa-funded scientific study. Photo / Thinkstock

Modern civilisation is heading for collapse within a matter of decades because of growing economic instability and pressure on the planet's resources, according to a scientific study funded by Nasa.

Using theoretical models to predict what will happen to the industrialised world over the course of the next century or so, mathematicians found that even with conservative estimates things started to go very badly, very quickly.

Referring to the past collapses of often very sophisticated civilisations - the Roman, Han and Gupta Empires for example - the study noted that the elite of society have often pushed for a "business as usual" approach to warnings of disaster until it is too late.

In the report based on his "Human And Nature Dynamical" (Handy) model, the applied mathematician Safa Motesharri wrote: "the process of rise-and-collapse is actually a recurrent cycle found throughout history".

His research, carried out with the help of a team of natural and social scientists and with funding from Nasa's Goddard Space Flight Center, has been accepted for publication in the Ecological Economics journal, the Guardian reported.

Motesharri explored the factors which could lead to the collapse of civilisation, from population growth to climate change, and found that when these converge they can cause society to break down because of the "stretching of resources" and "the economic stratification of society into 'Elites' and 'Masses'".

Using his Handy model to assess a scenario closely resembling the current state of the world, Motesharri found that civilisation "appears to be on a sustainable path for quite a long time, but

even using an optimal depletion rate and starting with a very small number of Elites, the Elites eventually consume too much, resulting in a famine among the Masses that eventually causes the collapse of society".

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Gallery

The report stressed, however, that the worst-case scenario of collapse is not inevitable, and called on action now from the so-called real world "Elites" to restore economic balance.

"Collapse can be avoided and population can reach equilibrium if the per capita rate of depletion of nature is reduced to a sustainable level, and if resources are distributed in a reasonably equitable fashion," the scientists said.

This is not the first time scientists have tried to warn us of potentially impending global disaster. Last year it emerged that Stephen Hawking and a team of Britain's finest minds are drawing up a "doomsday list" of the catastrophic low-risk (but high-impact) events that could devastate the world.

- UK Indepdendent