

Are we on the road to civilization collapse?

<http://www.bbc.com/future/story/20190218-are-we-on-the-road-to-civilisation-collapse>

By Luke Kemp, 19 February 2019

Studying the demise of historic civilisations can tell us how much risk we face today, says collapse expert Luke Kemp. Worryingly, the signs are worsening.

Great civilisations are not murdered. Instead, they take their own lives.

So concluded the historian Arnold Toynbee in his 12-volume magnum opus *A Study of History*. It was an exploration of the rise and fall of 28 different civilisations.

He was right in some respects: civilisations are often responsible for their own decline. However, their self-destruction is usually assisted.

The Roman Empire, for example, was the victim of many ills including overexpansion, climatic change, environmental degradation and poor leadership. But it was also brought to its knees when Rome was sacked by the Visigoths in 410 and the Vandals in 455.

Collapse is often quick and greatness provides no immunity. The Roman Empire covered 4.4 million sq km (1.9 million sq miles) in 390. Five years later, it had plummeted to 2 million sq km (770,000 sq miles). By 476, the empire's reach was zero.

Our deep past is marked by recurring failure. As part of my research at the Centre for the Study of Existential Risk at the University of Cambridge, I am attempting to find out why collapse occurs through a historical autopsy. What can the rise and fall of historic civilisations tell us about our own? What are the forces that precipitate or delay a collapse? And do we see similar patterns today?

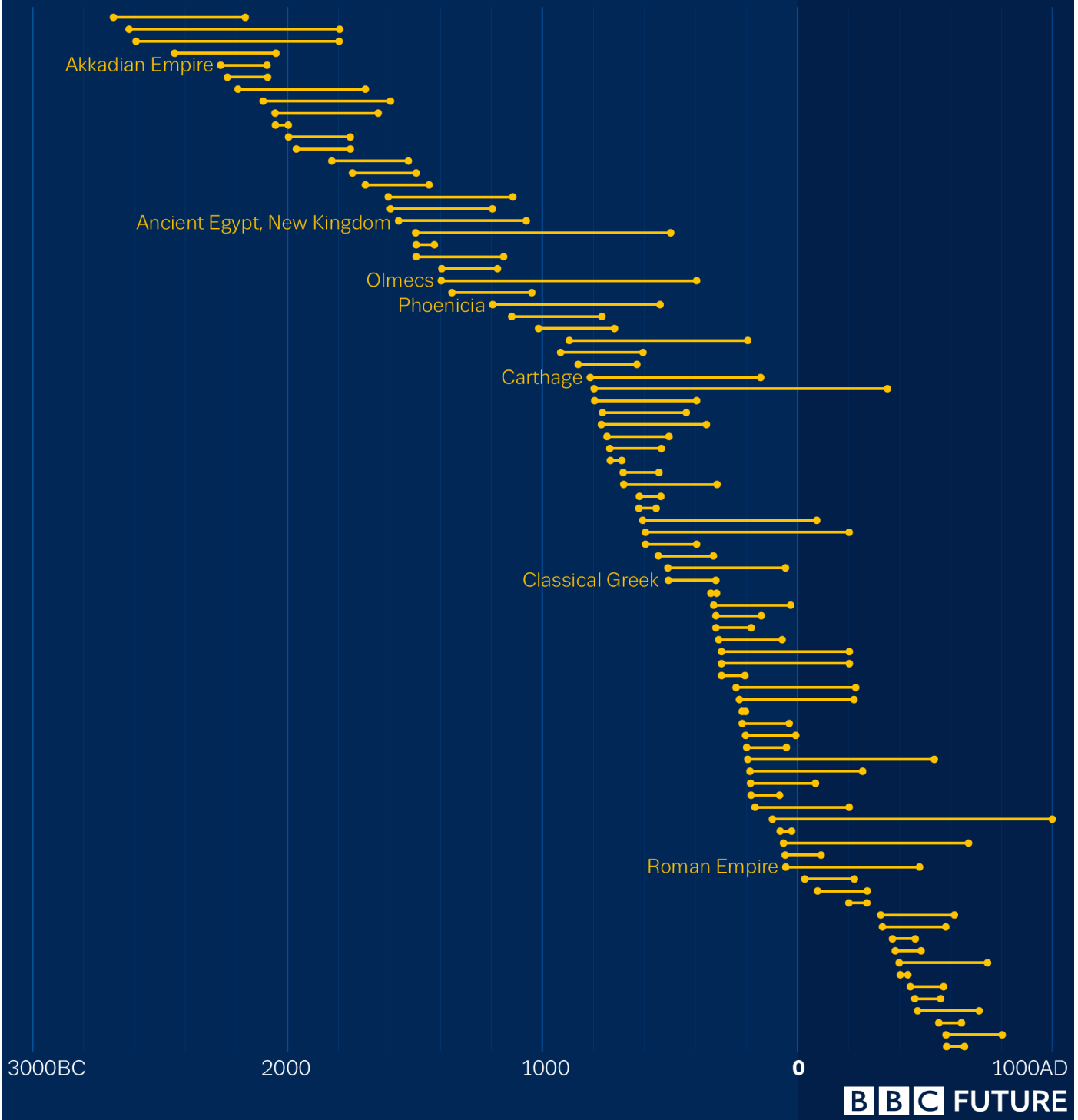
The first way to look at past civilisations is to compare their longevity. This can be difficult, because there is no strict definition of civilisation, nor an overarching database of their births and deaths.

In the graphic below, I have compared the lifespan of various civilisations, which I define as a society with agriculture, multiple cities, military dominance in its geographical region and a continuous political structure. Given this definition, all empires are civilisations, but not all civilisations are empires. The data is drawn from two studies on the growth and decline of empires (for **3000-600BC** and **600BC-600**), and an informal, crowd-sourced **survey of ancient civilisations** (which I have amended).

Collapse can be defined as a rapid and enduring loss of population, identity and socio-economic complexity. Public services crumble and disorder ensues as government loses control of its monopoly on violence.

Ancient civilisations

The average lifespan of a civilisation is 336 years 



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Virtually all past civilisations have faced this fate. Some recovered or transformed, such as the Chinese and Egyptian. Other collapses were permanent, as was the case of Easter Island. Sometimes the cities at the epicentre of collapse are revived, as was the case with Rome. In other cases, such as the Mayan ruins, they are left abandoned as a mausoleum for future tourists.

What can this tell us about the future of global modern civilisation? Are the lessons of agrarian empires applicable to our post-18th Century period of industrial capitalism?

I would argue that they are. Societies of the past and present are just complex systems composed of people and technology. The theory of “normal accidents” suggests that complex technological systems regularly give way to failure. So collapse may be a normal phenomenon for civilisations, regardless of their size and stage.

We may be more technologically advanced now. But this gives little ground to believe that we are immune to the threats that undid our ancestors. Our newfound technological abilities even bring new, unprecedented challenges to the mix.

And while our scale may now be global, collapse appears to happen to both sprawling empires and fledgling kingdoms alike. There is no reason to believe that greater size is armour against societal dissolution. Our tightly-coupled, globalised economic system is, if anything, more likely to make crisis spread.



Climatic pressures are worsening

If the fate of previous civilisations can be a roadmap to our future, what does it say? One method is to examine the trends that preceded historic collapses and see how they are unfolding today.

While there is no single accepted theory for why collapses happen, historians, anthropologists and others have proposed various explanations, including:

CLIMATIC CHANGE: When climatic stability changes, the results can be disastrous, resulting in crop failure, starvation and desertification. The collapse of the Anasazi, the Tiwanaku civilisation, the Akkadians, the Mayan, the Roman Empire, and many others have all coincided with abrupt climatic changes, usually droughts.

ENVIRONMENTAL DEGRADATION: Collapse can occur when societies overshoot the carrying capacity of their environment. This ecological collapse theory, which has been the subject of **bestselling books**, points to excessive deforestation, water pollution, soil degradation and the loss of biodiversity as precipitating causes.

INEQUALITY AND OLIGARCHY: Wealth and political inequality can be central drivers of social disintegration, as **can oligarchy and centralisation of power** among leaders. This not only causes social distress, but handicaps a society's ability to respond to ecological, social and economic problems.

The field of cliodynamics models how factors such as equality and demography correlate with political violence. Statistical analysis of previous societies suggests that this **happens in cycles**. As population increases, the supply of labour outstrips demand, workers become cheap and society becomes top-heavy. This inequality undermines collective solidarity and political turbulence follows.

COMPLEXITY: Collapse expert and historian Joseph Tainter has proposed that societies eventually **collapse under the weight** of their own accumulated complexity and bureaucracy. Societies are problem-solving collectives that grow in complexity in order to overcome new issues. However, the returns from complexity eventually reach a point of diminishing returns. After this point, collapse will eventually ensue.

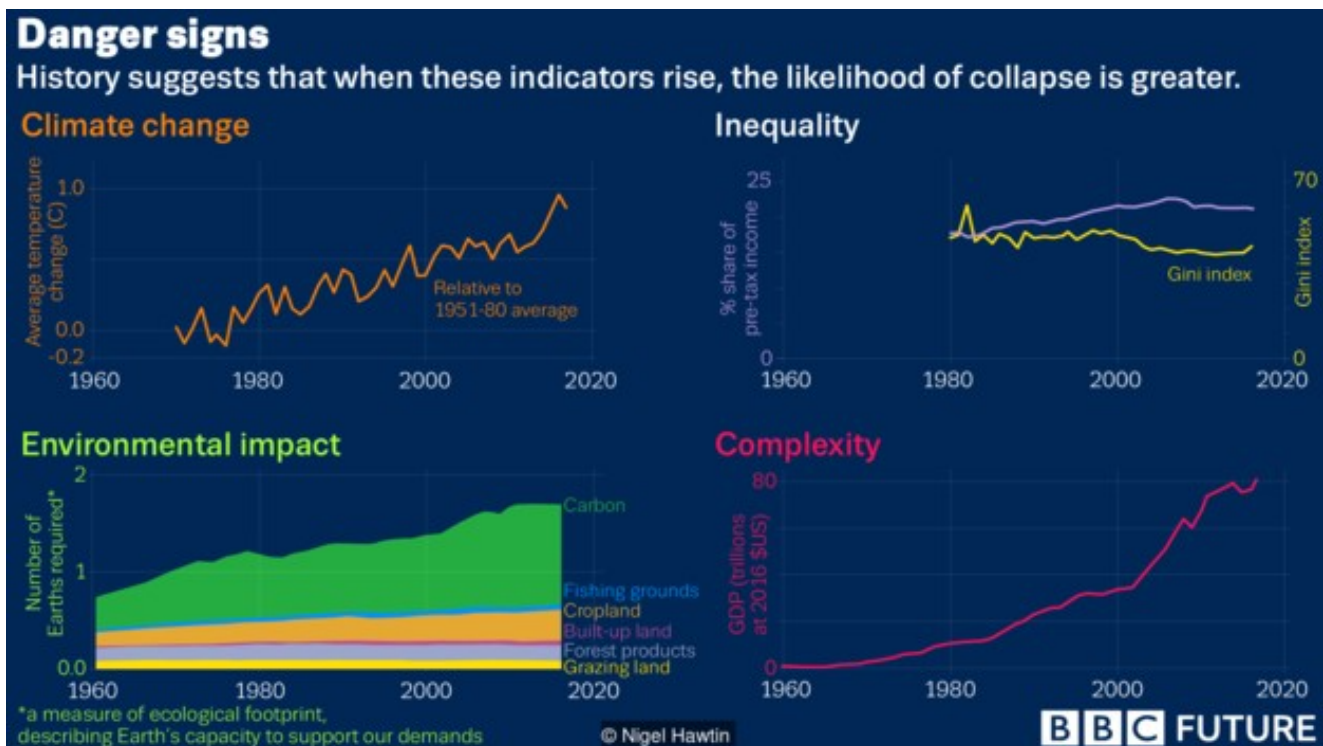
Another measure of increasing complexity is called Energy Return on Investment (EROI). This refers to the ratio between the amount of energy produced by a resource relative to the energy needed to obtain it. Like complexity, EROI appears to have a point of diminishing returns. In his book **The Upside of Down**, the political scientist Thomas Homer-Dixon observed that environmental degradation throughout the Roman Empire led to falling EROI from their staple energy source: crops of wheat and alfalfa. The empire fell alongside their EROI. Tainter also blames it as a chief culprit of collapse, including for the Mayan.

EXTERNAL SHOCKS: In other words, the "four horsemen": war, natural disasters, famine and plagues. The Aztec Empire, for example, was brought to an end by Spanish invaders. Most early agrarian states were fleeting due to deadly epidemics. The concentration of humans and cattle in walled settlements with poor hygiene made disease outbreaks unavoidable and catastrophic. Sometimes disasters combined, as was the case with the **Spanish introducing salmonella** to the Americas.

RANDOMNESS/BAD LUCK: Statistical analysis on empires suggests that collapse is random and independent of age. Evolutionary biologist and data scientist Indre Zliobaite and her colleagues have observed a similar pattern in the evolutionary record of species. A common explanation of this apparent randomness is the “**Red Queen Effect**”: if species are constantly fighting for survival in a changing environment with numerous competitors, extinction is a consistent possibility.

Despite the abundance of books and articles, we don't have a conclusive explanation as to why civilisations collapse. What we do know is this: the factors highlighted above can all contribute. Collapse is a tipping point phenomena, when compounding stressors overrun societal coping capacity.

We can examine these indicators of danger to see if our chance of collapse is falling or rising. Here are four of those possible metrics, measured over the past few decades:



Temperature is a clear metric for climate change, **GDP is a proxy** for complexity and **the ecological footprint** is an indicator for environmental degradation. Each of these has been trending steeply upwards.

Inequality is more difficult to calculate. The typical measurement of the **Gini Index** suggests that **inequality** has decreased slightly globally (**although it is increasing within countries**). However, the Gini Index can be misleading as it only measures relative changes in income. In other words, if two individuals earning \$1 and \$100,000 both

doubled their income, the Gini would show no change. But the gap between the two would have jumped from \$99,999 to \$198,000.

Because of this, I have also depicted the **income share of the global top 1%**. The 1% have increased in their share of global income from approximately 16% in 1980 to over 20% today. Importantly, wealth inequality is even worse. The share of global wealth from the **1% has swelled** from 25-30% in the 1980s to approximately 40% in 2016. The reality is likely to be starker as these numbers do not **capture wealth and income siphoned** into overseas tax havens.

Studies suggest that the EROI for fossil fuels has been **steadily decreasing over time** as the easiest to reach and richest reserves are depleted. Unfortunately, most renewable replacements, such as solar, have a markedly lower EROI, largely due to their energy density and the rare earth metals and manufacturing required to produce them.

This has led much of the literature to discuss the possibility of an “**energy cliff**” as EROI declines to a point where current societal levels of affluence can no longer be maintained. The energy cliff **need not be terminal** if renewable technologies continue to improve and energy efficiency measures are speedily implemented.

Measures of resilience

The somewhat reassuring news is that collapse metrics are not the entire picture. Societal resilience may be able to delay or prevent collapse.

For example, globally “economic diversity” – a measurement of the diversity and sophistication of country exports – is greater today than it was in the 1960s and 1970s, as measured by the **Economic Complexity Index (ECI)**. Nations are, on average, less reliant on single types of exports than they once were. For example, a nation that had diversified beyond only exporting agricultural products would be more likely to weather ecological degradation or the loss of trading partners. The ECI also measures the knowledge-intensity of exports. More skilled populations may have a greater capacity to respond to crises as they arise.

Similarly, innovation – as measured by **per capita patent applications**– is also rising. In theory, a civilisation might be less vulnerable to collapse if new technologies can mitigate against pressures such as climate change.

It's also possible that “collapse” can happen without violent catastrophe. As Rachel Nuwer **wrote on BBC Future in 2017**, “in some cases, civilisations simply fade out of existence – becoming the stuff of history not with a bang but a whimper”.

Still, when we look at all these collapse and resilience indicators as a whole, the message is clear that we should not be complacent. There are some reasons to be optimistic, thanks to our ability to innovate and diversify away from disaster. Yet the world is worsening in areas that have contributed to the collapse of previous societies. The climate is changing, the

gap between the rich and poor is widening, the world is becoming increasingly complex, and our demands on the environment are outstripping planetary carrying capacity.

The rungless ladder

That's not all. Worryingly, the world is now deeply interconnected and interdependent. In the past, collapse was confined to regions – it was a temporary setback, and people often could easily return to agrarian or hunter-gatherer lifestyles. For many, it was even a welcome reprieve from the oppression of early states. Moreover, the weapons available during social disorder were rudimentary: swords, arrows and occasionally guns.

Today, societal collapse is a more treacherous prospect. The weapons available to a state, and sometimes even groups, during a breakdown now range from biological agents to nuclear weapons. New instruments of violence, such as **lethal autonomous weapons**, may be available in the near future. People are increasingly specialised and disconnected from the production of food and basic goods. And a changing climate may irreparably damage our ability to return to simple farming practices.

Think of civilisation as a poorly-built ladder. As you climb, each step that you used falls away. A fall from a height of just a few rungs is fine. Yet the higher you climb, the larger the fall. Eventually, once you reach a sufficient height, any drop from the ladder is fatal.

With the proliferation of nuclear weapons, we may have already reached this point of civilisational “terminal velocity”. Any collapse – any fall from the ladder – risks being permanent. Nuclear war in itself could result in an existential risk: either the extinction of our species, or a permanent catapult back to the Stone Age.

While we are becoming more economically powerful and resilient, our technological capabilities also present unprecedented threats that no civilisation has had to contend with. For example, the climatic changes we face are of a different nature to what undid the Maya or Anazasi. They are global, human-driven, quicker, and more severe.

Assistance in our self-imposed ruin will not come from hostile neighbors, but from our own technological powers. Collapse, in our case, would be a **progress trap**. The collapse of our civilisation is not inevitable. History suggests it is likely, but we have the unique advantage of being able to learn from the wreckages of societies past.

We know what needs to be done: emissions can be reduced, inequalities levelled, environmental degradation reversed, innovation unleashed and economies diversified. The policy proposals are there. Only the political will is lacking. We can also invest in recovery.

There are already well-developed ideas for improving the ability of **food** and **knowledge** systems to be recuperated after catastrophe. Avoiding the creation of dangerous and widely-accessible technologies is also critical. Such steps will lessen the chance of a future collapse becoming irreversible.

We will only march into collapse if we advance blindly. We are only doomed if we are unwilling to listen to the past.

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