

What Kind of Crisis Is It?

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Abstract

Different explanations have been offered for the global financial crisis, reflecting different worldviews and different interpretative frames. This short paper uses an initial analysis based on understanding the crisis as the conjunction of a number of different – but overlapping – S-curves, of different lengths, to understand systemically the depth of the crisis. These curves include a finance S-curve, a technology S-curve, an energy S-curve, and a 'modernity' curve. However, while S-curves are a useful analytical tool, they are not integrative and they lack a narrative of transition from the tail of one curve to the start of the next. The authors explore the value of the 'panarchy' model, better known as a model for the behaviour of ecological systems, as a way to understand the transitions caused by the global financial crisis and some of the implications for policy makers.

Keywords: global financial crisis, worldviews, s-curve, panarchy

The nature of the global financial crisis has provoked much speculation since the bankruptcy of Lehman Brothers first sent markets, and then economies (at least in the North), into a tail spin in late 2008. Many competing explanations have been promoted. These span a crisis of the banking system, a crisis of governance, a crisis for economics, a crisis of globalisation, a crisis of complexity, a crisis of scale, and a crisis of democratic representation.

Some have even tried to argue that it was not a crisis at all, but merely a blip in which the risk management practices of some banks were found to be lacking (Gushurst, de Souza, & Wallace, 2008).

But why ask the question? Partly because this was – from some perspectives – the crisis that 'shouldn't have happened'. Politicians, on either side of the Atlantic at least, had boasted that new-found economic management skills had eliminated the business cycle, while the combination of globalisation and technology was, we were told, able to deliver continuing growth, even a 'long boom' (Schwartz & Leyden, 1997). The question is therefore worth asking because we are living in the aftermath of a 'future that failed'. This article seeks both to examine the nature of the crisis, and to give a sense of its depth by probing for its meaning at a number of levels.

We will argue that the reason for this proliferation of explanations is that trying to identify a single theme is almost certainly too simple. It looks at the crisis as the product of a moment in which the terminal phases of several long-run 'S-curves' are coinciding and reinforcing. Most of these S-curves are reaching the 'winter' stage of their lives.¹ These curves range in duration from 40 years to 250 years or more. They have varying degrees of interdependency. Our primary experience and interpretation of the global financial crisis, at the level of individual, social, and cultural perception, is linked to the curves which have most salience to our worldview.

This article, therefore, will unfold in three parts. First, we will explore the nature and the impact of these growth-decline curves. Then we will look briefly at barriers to understanding the crisis. Finally, we will examine their inter-connections, through the lens of the 'panarchy' framework, better known in the study of ecological systems, before offering some tentative conclusions for futures and for policy making.

Long Run S-curves

The S-curve phenomenon is a well-established pattern of growth and maturity in biological, as well as technological and economic, systems. The growth of an individual or population first starts slowly, then accelerates in a phase of exponential growth, and then decelerates and finally levels out (Stewart, 1989). Where in these successive stages a system is determines whether it is attaining dominance or is ripe for replacement or renewal. If many dimensions of development, acting over widely different time periods, all reach their culminating stage together, an entire ecosystem or socio-technical system may be poised for an episode of 'creative destruction.'

There are a number of S-curve waves or cycles in the socio-economic system which have contributed to the present crisis. For the purposes of this article we have chosen to look at four in more detail.

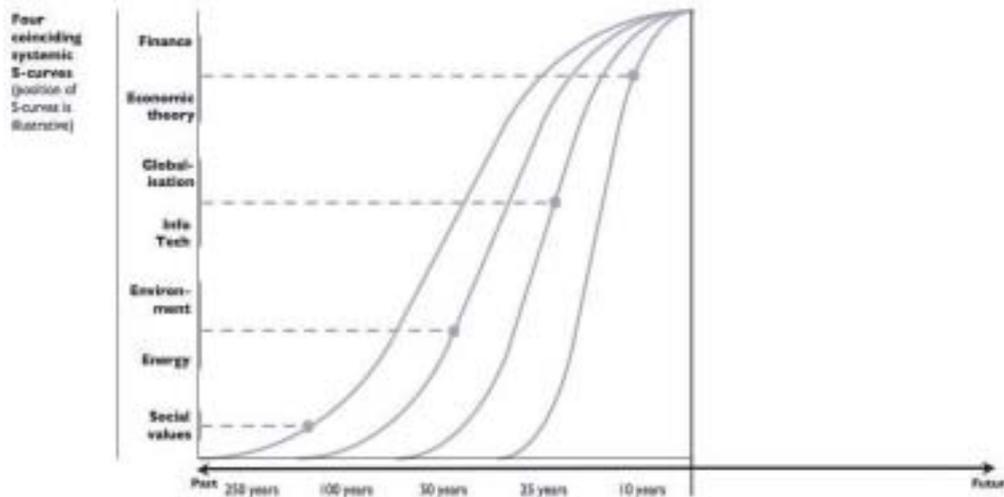


Figure 1. Four S-curves

The Financial S-curve

A relatively short cycle, dating from the late-1960s. Judging from banking sector data, much of the initial impetus came from the United States' decision to leave the Gold Standard in 1971, but it developed further through the promotion in the 1980s of policies designed to favour a 'neo-liberal' economic globalised economy. Such policies include the development of the World Trade Organisation as the arbiter of international trade rules and the deregulation of financial markets in London and New York.

Marxist critics have suggested that this was also part of a process of 'financialisation' designed to extend market-based models into all aspects of social and public life (see, for example, Blackburn, 2006 & 2008). Social market critics have identified the failure of regulatory models (Basel Committee, 2009), or the capture of regulatory institutions by the banks and their representatives (Hutton, 2009). Others suggest that it represented – certainly in the UK and the US – the capture of state policy-making processes by a narrow sectional financial interest (Alessandri & Haldane, 2009; CRESC, 2009; Kay, 2009).

This is perhaps the best understood of the cycles we discuss, and certainly has had the most print devoted to it. For this reason, it needs little further exposition here, other than to observe that if the crisis is also a crisis of economics, it is largely because economists allowed themselves to become theoretical cheer-leaders for this particular model of political economy (Krugman, 2009).

The Technology S-curve

A somewhat longer cycle is the Schumpeterian cycle, articulated most clearly (and most falsifiably) by Carlota Perez (2007). Perez has developed a model, influenced by Schumpeter, in which technological and economic history since the British Industrial revolution is punctuated by waves, or 'surges', of development of 50-60

years in which technological innovation and economic investment combine in repeating patterns. The first surge, which started in 1771, was based on cotton and canals; the fourth, dating from 1908, on cars and plastics; the current one, which started in 1971, on computers and communications.

There is space here only to summarise Perez' model. Briefly, each technological 'surge' runs through a phase of 'installation', in which entrepreneurial and financial interests combine; and then through a phase of 'deployment', in which production interests dominate. In between the two is an inflection point marked by an asset bubble and a crash (the dot.com boom in 2001, the Wall Street Crash).

Each wave, therefore, follows a pattern of emergence, bubble, crash, growth and saturation. Each is prone to asset bubbles as it approaches its midpoint. The current cycle, which dates from the invention of the microprocessor, has reached the deployment stage at which super-normal returns recede and 'normal returns' are increasingly common.²

In terms of the global financial crisis, however, there are aspects of Perez' model which are particularly relevant. First, each surge is more productive than the last; its reach and its density is greater than the previous surge. Second, each surge takes on a particular form of organisation, equipment, transport and communications, and, because of its role in developing the new platform, "the world of finance itself is among the pioneers in adopting the new paradigm" (Perez, 2009).

This offers an explanation for the deep integration of the finance sector and technology which has been a strong feature of the financial crisis, and for the ubiquity of connections between finance sectors. It also helps to explain an interpretation of the crisis as being one of comprehension; of information moving or being generated too quickly, and in too great a volume, to be processed by individuals and social institutions. Examples of this are the role of technology systems in the rapid development of the OTC derivatives market (Plansky, Regelman, & Lyman, 2008), and over-reliance on complex software-based assessments of risk (for example, see Honohan, 2008).

The Energy S-curve

The third long-wave story is of a long-run build of resource consumption and environmental crisis. There are different ways of dating this, but for present purposes the most useful is from the discovery of cheap and easy oil, just over a hundred years ago, and the accelerating intensification of energy consumption in daily and industrial life, especially in the rich world, ever since, along with the intensification of resource consumption more generally (Heinberg, 2003).

The consumption of fossil energy and other resources has significant direct and indirect environmental consequences, notably for carbon emissions. These are yet to have a decisive systemic impact, so the most important detail for understanding the financial crisis is the plateauing of oil production from the middle of the 2000-2010 decade, and the accompanying shift in perception about the future of oil supplies towards a prevailing view that conventional oil production has peaked, or is about to. Most of the oil price spike which prompted at least part of the recession was caused by increased demand, especially from emerging economies, against this background of flattening production. Even the International Energy Agency (2009), long optimistic

Finally, before proceeding, it is worth noting that the present technology curve is slightly lagging the other three. Using Perez' analysis, it is highly likely that the rate of information technology development will start to slow, although this will be disguised by the continuing spread of devices and applications. Nevertheless, the disruptive potential of fully deployed information technology, in combination with the threshold stages of the other curves, actually enhances the potential for system transformation.

Understanding the Crisis

As a species, we are not good either at managing complexity, or of thinking in long-term timescales (Diamond, 2005). As in the parable of the blind men and the elephant, different observers find something close to them, and compare it to something they already know. These are not so much competing meanings as parallel meanings. A complex, long-term story is bound to cause interpretative confusion.

Interpreting the crisis is harder because the ending of all of these four cycles tell us stories (as we noted earlier) which are dissonant from the dominant narratives of the age. Those who wish to believe it will still assert that market-driven globalisation will continue, albeit with a different emphasis, once the economic recovery gains momentum (such assertions were a staple of international meetings throughout 2009). The notion that the technological gains of the past forty years will continue exponentially, and that this alone will be enough to drive endless exponential economic growth, defies plausibility but is invested with a whole conceptual framework around the notion of the Singularity (Kurzweil, 2005).

The disturbing idea that the economic gains and industrial growth of the last century might be down to a one-time cheap energy windfall – rather than coming from innovation and ingenuity – remains at the edge of mainstream discourse. The concept of continuous expansion, meanwhile, is so deeply embedded in the psyche of the affluent North, that those who suggest it has run its course (such as Herman Daly) are not even ridiculed; instead, they are ignored.

The myth of cornucopian plenty sits squarely beneath all four narratives, and as Barbara Heinzen (2006) has observed, the story of an endlessly abundant natural world is one of the founding myths of the United States. The idea that several hundred years of heedless extraction might bring that to an end – or at least require a deep economic rethink – is too uncomfortable to be faced directly.

One way of considering this material is to suggest that the crisis was over-determined; the end of any of these curves could have caused it, albeit not with the same speed or scale. Each of the systems had its own dynamic. This multiplicity of causes suggests that a transformation is inevitable; even if the global system does dust itself down and revert to recent patterns, it will not do so for long.

At the same time, however, as Donald Schön (1973) has observed, all systems exhibit 'dynamic conservatism' in the face of external pressure; they adapt by the smallest amount necessary to maintain themselves with the minimum of disruption. This suggests that the process of transition will be drawn out.

But it is unlikely to be smoothly drawn out. Much of the theoretical and observational work on systems in decline suggests that they decay over a period of time, irreg-

ularly rather than smoothly, suffering from successive shocks at unpredictable intervals and of an unpredictable scale. (Homer-Dixon, 2007; Tainter, 1988). If the crisis was over-determined, so might also be the subsequent shocks. One can envisage a future in which shocks to the political economy of globalisation overlap with shocks to the expansion of technology that has underpinned it, and with shocks to the overall energy and environmental system. Policy makers, however, are not good at planning for disruptive transformations of the entire system. There is not a world of graceful degradation.

From S-curves to Panarchy

One of the problems of S-curve analysis, of course, is that it does not intrinsically lead to an explanation of what comes next. Historical experience suggests that one S-curve is followed by another – at least during the last 200 years of sustained overall growth. But what exactly is the dynamic of transition from the end of one curve to the beginning of the next? Like the curves themselves in most S-curve diagrams, the question is usually left hanging; one jumps, perhaps, or one falls.

So it is worth looking more closely at the nature of the transition between successive surges portrayed in the work of Carlota Perez. Effectively, the shift from one technology paradigm to the next is achieved through the mechanism of surplus speculative capital looking for a new home, in response to the declining rate of return associated with the previous techno-economic paradigm (in which returns have declined as the technology matures). During the transition, many are called, but few succeed. There is a period of narrative confusion as advocates of candidate technologies assert their respective claims. The stories about the next technologies (multiple stories, multiple technologies) compete to achieve prominence. There is an overhang (institutional and regulatory, as well as worldview) from the previous paradigm. It is only with hindsight that the winner appears clearly.

This has some similarities to the panarchy model, which is not well known outside the field of ecosystems and ecosystem management (Gunderson & Holling (eds), 2002)³. If the S-curve is essentially a story about rates of change within a system, panarchy does this too – but it also does more. Holling and Gunderson write: "our purpose is to develop an integrative theory to help us understand the changes occurring globally...particularly the kinds of changes that are transforming, in systems that are adaptive. Such changes are economic, ecological, social, and evolutionary." (Holling, Gunderson, & Ludwig, 2002).

Panarchy tells a story in which systems evolve through a figure of eight, during which the system exhibits higher or lower states of connectedness, and higher or lower levels of potential, in different combinations. There are different levels of system resilience at different places in the cycle. In effect it proposes a theory which links the sated end of one phase with the underdeveloped start of the next one. It allows for the fact that systems don't always succeed in this transition. Finally, it also imagines that there might be nested cycles, in which different systems, moving at different speeds, are connected. It should also be noted that there remains some controversy as to whether the model can apply to social and economic systems. Our contention in this paper is that it can.

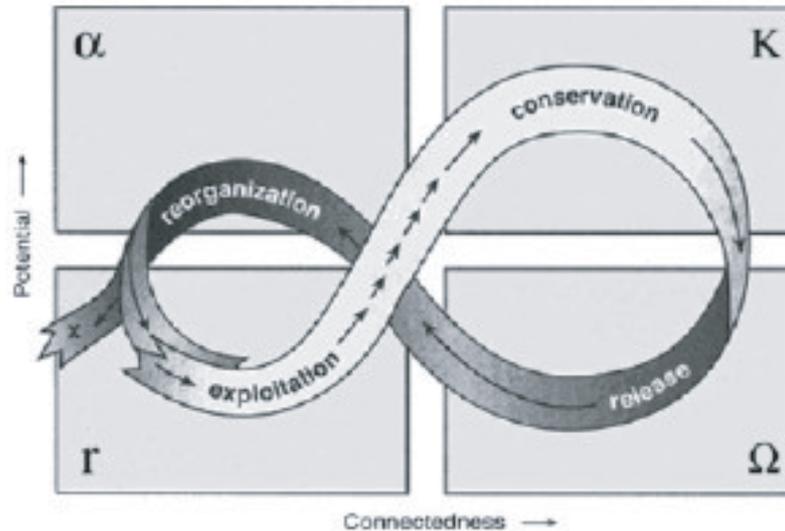


Figure 3. The panarchy cycle

Source: Gunderson and Holling, (Eds). Panarchy

To summarise the model, then (it is seen Figure 3), it passes through four phases. In the 'exploitation' phase (γ) – exploitation here is meant in a descriptive and non-pejorative ecological sense – there is expansion, in which a new system finds a niche and is able to develop rapidly, building connections and potential. This is a period of system and capacity building, which creates the platform for rapid expansion.

The emphasis in the conservation stage (κ), is on accumulation and storage of energy and materials. In terms of social and technical systems, this is a period of scaling up, of mature products. But the system also reaches climax, and its extensive connections lead to system rigidity and create vulnerability to change in the wider environment.

The 'release' phase, or omega (Ω), therefore, is a period of rapid decline in the face of changing conditions or new competition. In terms of social systems, leadership is important.

Finally, in the alpha (α), or 'reorganisation', stage, potential is high but connection weak. The emphasis is on developing sufficient variety to create opportunities for building new connections and for the system to redesign itself to have a chance of survival. Not all systems succeed in this.

Although the parallels between the S-curve approach and the Panarchy model are not exact, there are similarities, and they are listed in the table here, along with the relevant analogies with Carlota Perez' model, to aid understanding and comparison.

Table 1
Comparing different models of development⁴

S-CURVE	PEREZ	PANARCHY
Spring	Eruption	Reorganisation/Exploitation
Summer	Frenzy	Exploitation
Inflection point	Crash	
Autumn	Synergy	Conservation
Winter	Maturity	Conservation/Release

The second value of the panarchy cycle is that it proposes that different panarchy cycles, travelling at different speeds, can nest within each other, and that these have particular types of relationships with each other. In other words, it can help us to make connections between the different S-curves which we explored in the first part of this article.

There are two relationships which are of particular value in thinking about integrated systems. The first is 'revolt,' which occurs when fast, small events or systems overwhelm large, slow ones. The second is 'remember'. This happens when the potential accumulated and stored in the larger, slow levels influences the reorganization phase of a smaller, faster level. The fast levels invent, experiment and test; the slower levels stabilise and conserve accumulated memory of past, successful experiments.

In the short space of this paper it will be possible to explore only the surface of this approach in terms of the global financial crisis.

Reading the financial curve in terms of the panarchy cycle, for example, the changes brewing in the banking system during the 1970s were similar to the 'reorganisation' phase. The period immediately following the 'Big Bang' in the UK, and other 1980s deregulation, was akin to the 'exploitation' phase, in which the industry built new capacity and new relationships to exploit the new opportunity. This was followed by the 'conservation' phase, as markets developed and the size and prestige of institutions steadily grew. This is a longer, slower, phase. The sub-prime crisis was the sudden 'release' phase, and a sign – borrowing the ecological metaphor – that the financial system had grown too large and complex to be sustainable, and was starting to destroy itself. Similar stories can be told for the oil curve and the modernity curve. (The technology curve, in contrast, is still in the conservation stage).

Social Systems and Change

However, unlike ecological systems, human systems are reflexive. "Social systems incorporate an additional factor", writes C.S. Holling (2004). "Clever human beings have learned to look forward and create the future before it happens. These innovations are often local. Others have identified ways to persist within existing structures."

This latter behaviour is an example of Schön's (1973) 'dynamic conservatism, discussed earlier. And Thomas Homer-Dixon (2007) has described the way in which, in the face of shocks, systems extend themselves, and in doing so make themselves more rigid and less responsive to change – but more prone to collapse.

For both of these reasons, it usually takes multiple shocks to tip a well-developed social system into the 'release' phase (Tainter, 1988). Such systems seek to prolong the 'conservation' phase as long as possible. One of the lessons from this analysis of the global financial crisis is that it will be the next shocks, or even the ones after that, which will conclusively shift the system towards the 'release' and 'reorganisation' stages. It seems as likely to come from the energy system, or a change in values associated with globalisation and the end of modernity, as from the banking system itself.

As mentioned above, one of the features of the panarchy model is that it allows for relationships between nested systems, some moving more slowly than others. It proposes that faster-moving systems are a source of innovation, while slower moving levels conserve and stabilise.

One of the consequences of this is that transitions are irregular and uneven. There is variation both *between* different systems, and *within* systems, which leads to interpretative conflict – itself a sign that the 'conservation' phase is ending. An ecological system which collapsed as comprehensively as the banking system did in 2007-08 would have moved decisively into the 'release' phase. Yet in late 2009, some actors evidently still believe that the purpose of public intervention has been to haul their businesses (and them) back to the opulence of the 'conservation' phase. Regulators, though, taking different perspectives, including the slower perspective of governance, are increasingly talking as if 'reorganisation' is inevitable (Alessandri & Haldane, 2009; Turner, 2009).

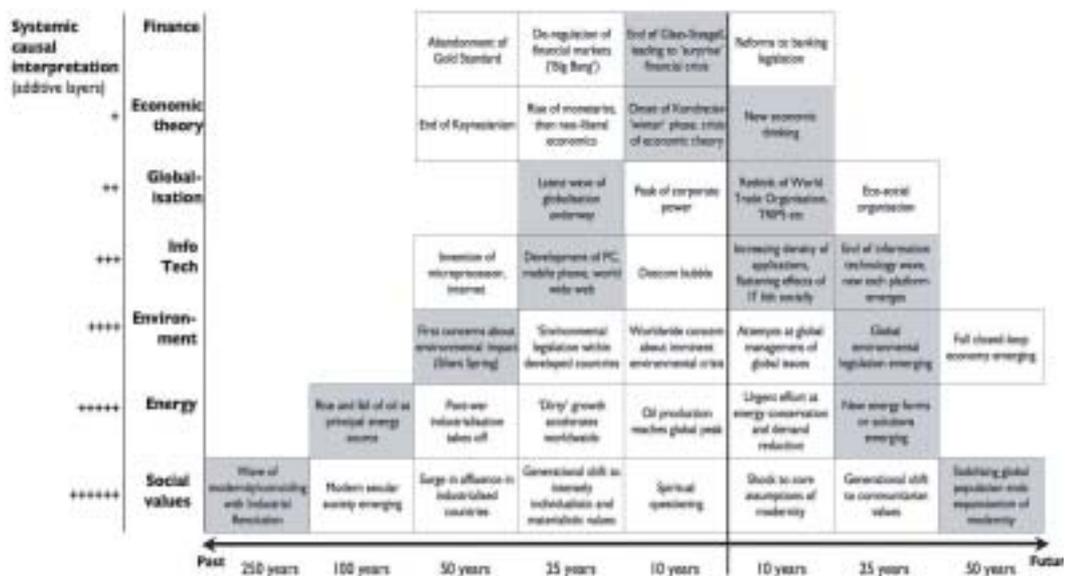


Figure 4. The unfolding future

Some Implications for Policy-Makers and Futurists

There are some obvious lessons for policy-makers in the analysis which we have presented here. The main one is that in several important systems we will – soon – move away from the familiar area of 'conservation', in the panarchy framework, in which institutional behaviour, assumptions, and worldviews are well-rehearsed, well-known, and well-internalised. We can then expect to move into the unstable (and more rapid) phases of 'release' and 'reorganisation,' in which it is more important to listen to the unfamiliar, to watch for emerging issues, and for new social practices, and to create space for innovation (social as well as commercial) by encouraging new connections (see, for example, Hawken, 2008).

There is a warning, too, that there is a cost in listening too closely to familiar (and influential) interests, whether in the financial, energy, or media sectors. Their motives are to preserve the status quo, which they associate with wealth production, but which now would preserve conditions favourable to them but be costly, and increasingly risky, for others.

The risk comes in particular from a third observation. Because we are in a dangerous place somewhere between 'conservation' and 'release' on several of the panarchy cycles, we are likely to see further shocks. But policy makers are not good at living in liminal moments, betwixt and between. They prefer apparent certainty to actual uncertainty. Instead, we are in a world of incomplete 'sense-making', in which different parts of the system, and different systems, offer competing narratives.

From a systems perspective, this also marks a change in the type of intervention which is likely to have a significant effect. Drawing on Meadows' (2009) 'leverage points', it involves a shift from the modest tinkering approaches towards the lowest level of her list to some of the more fundamental interventions at the highest. The massive programme of quantitative easing, in the United Kingdom, the United States and elsewhere, for example, is about changing the size of the stocks. It is close to the lowest level of Meadows' list, and has produced some perverse outcomes. Some of the regulatory suggestions have been about changing information flows, further up the list, but also likely to have perverse outcomes.

There are more radical suggestions, which draw on higher leverage. These include changing ownership structures, changing the goals (for example via the Tobin tax), or changing the paradigms (for example by suggesting that bankers should be encouraged to leave the country because the state can no longer afford to bail out the banking system.) All have achieved relatively rapid traction as policy ideas despite the hostility of the financial industry, which is another indication that the 'conservation' phase is all but over.

And what can we learn from a futures' perspective? In her exploration of the sociology of the future, Barbara Adam (2005) makes a distinction between 'the future traded' and 'the future traversed.' The traded future is in a world of finance, of banking, risk, insurance, actuarial calculation, and financial futures. By her account, "An empty future conceived in terms of money is there for the taking, open to commodification, colonisation and control, available for exploitation, exploration and elimination". In contrast, as modernity and socially-exploitative finance reach their limits, we are able

to create futures in which "costs have to be paid, disasters rectified" by those who cause them. It creates the opportunity, once more, to take responsibility for the future.

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Notes

1. We use here Theodore Modis' (1998) seasonal language to describe S-curves, in which they run through Spring, Summer, Fall (or Autumn), and Winter.
2. In passing, one of the insights from this analysis is that Microsoft is an 'installation' company, and Google is a 'deployment' company.
3. 'Panarchy', or rules of nature, is named for Pan, the Greek god of nature, and in opposition to 'hierarchy', or 'sacred rules'.
4. In this analysis we diverge slightly from the comparison of panarchy and S-curves in *Panarchy* (p125).

References

- Adam, Barbara. (2005). Futures told, tamed and traded. ESRC, In Pursuit of the Future. <http://www.cardiff.ac.uk/socsi/futures/index.html>, retrieved 7 January 2010.
- Albrow, Martin. (1998). *The global age*. Cambridge: Polity.
- Alessandri, Piergiorgio, & Anarew Haldane. (6, November, 2009). Banking on the state. London: Bank Retrieved December 9, 2009, from <http://www.bankofengland.co.uk/publications/speeches/2009/speech409.pdf>
- Basel Committee on Banking Supervision. (2009). Consultative document: Strengthening the resilience of the banking sector, basel, Bank for International Settlements.
- Blackburn, Robin. (2006). Financialization and the fourth dimension. *New Left Review*, 39.
- Blackburn, Robin. (2008). The sub-prime crisis. *New Left Review*, 50.
- Brook, Timothy. (2009). *Vermeer's hat*. London: Profile.
- CRESC (Centre for Research on Socio-Cultural Change). (2009). An alternative report on UK Banking Reform. Manchester, CRESC. Retrieved December 6, 2009, from <http://www.cresc.ac.uk/publications/documents/AlternativereportonbankingV2.pdf>
- Diamond, Jared. (2005). *Collapse*. London: Allen Lane.
- Gunderson, Lance H., & Crawford S. Holling. (Buzz). (Eds.).(2002). *Panarchy*. Washington, DC: Island.
- Gushurst, Klaus-Peter, de Souza Jean, & Wallace, Vanessa. (2008). Taking a calmer view, Strategy+Business, Resilience Report, October. Retrieved October 6, 2009, from <http://www.strategy-business.com/article/rr00063>
- Hawken, Paul. (2008). *Blessed unrest*. London: Penguin.
- Heinberg, Richard. (2003). *The party's over*. Forest Row: Clairview Books.
- Heinzen, Barbara. (2006). *Feeling for stones*. London, Heinzen. Retrieved January 6, 2010, from <http://www.barbaraheinzen.com>
- Holling, Crawford S. (2004). From complex regions to complex worlds. *Ecology and Society*, 9(1), 11. Retrieved December 28, 2009, from <http://www.ecologyandsociety.org/vol9/iss1/art11/>
- Holling, Crawford S., Lance H. Gunderson, & Don Ludwig. (2002). In quest of a theory of adaptive change. In Lance H., Gunderson, & Crawford S. Holling (Eds.), *Panarchy*. Washington, DC: Island.
- Homer-Dixon, Thomas. (2007). *The upside of down*. London: Souvenir.
- Honohan, Patrick. (2008). Risk management and the costs of the banking crisis. *National Institute Economic Review*, 206, 15.
- Hutton, Will. (21 October, 2009). It's payback time for our bailed-out banks. London: The Guardian.
- Inglehart, Ronald. (1997). *Modernization and postmodernization*. Princeton: Princeton University Press.
- International Energy Agency. (2009). *World energy outlook 2009*. Executive summary, Presentation to press. Retrieved November 14, 2009, from <http://www.iea.org/textbase/npsum/weo2009sum.pdf>
http://www.iea.org/speech/2009/Tanaka/WEO2009_Press_Conference.pdf

- Kay, John. (11 November, 2009). The future of market. *Open democracy*. Retrieved November 27, 2009, <http://www.opendemocracy.net/openeconomy/john-kay/future-of-markets>
- Kurzweil, Ray. (2006). *The singularity is near*. London: Gerald Duckworth & Co.
- Krugman, Paul. (2 September, 2009). How did economists get it so Wrong?. New York: *New York Times*.
- Meadows, Donella. In Diana Wright (Ed.).(2009). *Thinking in systems*. London: Earthscan.
- Modis, Theodore. (1998). *Conquering uncertainty*. New York: McGraw-Hill/ Business Week.
- Perez, Carlota. (2007). Finance and technical change: A long term view. In Horst Hanusch, & Andreas Pyka. (Eds.), *Elgar companion to neo-schumpeterian economics*. Cheltenham, UK: Edward Elgar.
- Perez, Carlota. (2009). Technological roots and structural implications of the double bubble at the turn of the Century. CERF Working Paper 31. Retrieved December 28, 2009, from www.carlotaperez.org
- Plansky, John, Roman Regelman, & Charles Lyman. (2008). *The OTC derivatives boom*. Boston: Booz & Company.
- Schon, Donald. (1973). *Beyond the stable state*. Harmondsworth: Penguin.
- Schwartz, Peter, & Peter Leyden. (1997). The long boom: A history of the future 1980-2020. *Wired* 5.07. Retrieved 3 January, 2010, from <http://www.wired.com/wired/archive/5.07/longboom.html>
- Stewart, Hugh B. (1989). *Recollecting the future*. Homewood, IL: Dow Jones-Irwin.
- Tainter, Joseph. (1988). *The collapse of complex societies*. Cambridge: Cambridge University Press.
- Turner, Adair. (2009). How to tame global finance. *Prospect* (UK), No. 162.