

Sander van der Leeuw
Arizona State University



Ph.D., University of Amsterdam, 1976
Foundation Professor, Dean of the School of Sustainability
at ASU and co-Chair of the Complex Adaptive Systems
Initiative at ASU

An archaeologist and historian by training, Sander van der Leeuw did archaeological or anthropological fieldwork in Syria, Holland, France, Mexico and the Philippines. After teaching appointments at Leyden, Amsterdam, Cambridge (UK) and Paris (Sorbonne) he moved to Arizona State University in 2003.

Van der Leeuw's core research theme is the study of the dynamics of societies and their environments, but he has also contributed to the reconstruction of ancient technologies, (ancient and modern) regional man-land relationships, Geographic Information Systems and modeling. Since 1981, he has worked on applying Complex Systems Theory in various ways in all these domains. From 1992 to 1999, he coordinated a series of major re-search projects on the natural and anthropogenic causes of desertification, land degradation and land abandonment and their spatial manifestations, using the Complex Systems approach.

More recently, he has been studying the phenomenon of innovation. The ISCOM project (The Information Society as a Complex System, 2003-2006) investigated the relationship between innovation and urban dynamics. He is currently involved in applying Complex Systems approaches to the study of this phenomenon in the United States, and in particular in Phoenix.

In July 2001, he was appointed Secretary-General of the French National Council for the Coordination of the Humanities and Social Sciences. This was followed by an appointment as Deputy Director for Social Sciences at the CNRS (2002-2003) and at the French National Institute for the Sciences of the Universe, in charge of a program similar to the Long Term Ecological Research program in the US.

In 2003, he joined ASU as Professor of Anthropology and Director of the School of Human Evolution and Social Change, an interdisciplinary unit based around anthropology. He is Corresponding Member of the Royal Dutch Academy of Arts and Sciences, Member of the Institut Universitaire de France and External Professor at the Santa Fe Institute.

Abstract*Complex Systems Theory, Sustainability and Innovation*

In the last twenty years, researchers have come to the conclusion that we cannot study the evolution of societies separately from those of their environments. Over time, the two have become closely intertwined, so now humans have such an impact on their environment that the latter no longer follows its own dynamics.

In the evolution that led to this situation, we can distinguish three major phases in which humans invented major new ways to process matter, energy and information, as well as widening and deepening their interaction with the environment.

- The first of these, covering most of the early evolution of human ancestors, is essentially a Darwinian biological process of acquisition of sufficient short-term working memory that frees people from the biological limitations of their cognition.
- The second encompasses the early stages of socio-cultural development of 'tools for thought' to deal with subsistence, technology and social aggregation.
- The third encompasses the creation of a feedback system between the creation of knowledge and the accumulation of energy that allows towns and empires to emerge.

The paper briefly outlines this development, and then illustrates how this has affected both the Roman Empire and the emergence of Western Europe as a world power between c. AD 1000 and the 20th Century.

It then shifts focus to the phenomenon of 'crisis' and outlines, based on a case-study in the recent past of Northern Greece, some of the dynamics that have led to such a crisis, as an example both of our current environmental crisis and crises more generally. The fundamental driver in that process is the interaction between learning and intervention in the environment on the one hand, and the emergence of unintended consequences on the other. To develop this line of thought, the paper adopts a combined Complex Systems and Resilience perspective.

Finally, the paper will argue that we therefore need to change the role and scope of innovation in our society from one focused on 'value creation' through invention of artifacts for the consumer society, to one that much more selectively innovates, and is aware of the consequences of the innovation before it is implemented. It concludes with some elements of this change in perspective.