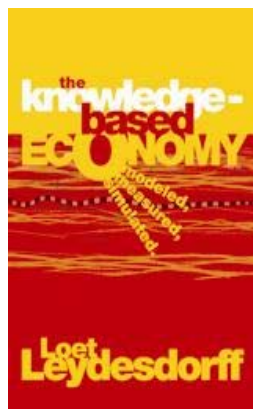


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The Challenge of Cybermetrics
Review of the Book: "The Knowledge-Based Economy: Modeled, Measured, Simulated" by
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The Knowledge-Based Economy: Modeled, Measured, Simulated

by Loet Leydesdorff

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As information and communication technologies (ICTs) have become essential tools for knowledge production and communication, we need to understand their role in the science system and in society at large. How have ICTs contributed to recent changes in science-society interactions and the involvement of new societal actors in the creation, maintenance and utilization of scientific information? As Van den Besselaar points out in a previous issue of this journal (Van den Besselaar 2006), it is increasingly understood how new media, such as the web, are in fact extending (and therefore changing) existing social and communication spaces.

New media become part of the existing communication spaces, and at the same time contribute to change. In other words, the virtual and the real are merging into something that can be called a hybrid space. It is still an open question how the increasing use of ICTs shapes hybrid spaces and thus influences the formation of knowledge based communities. It is expected that the availability of electronic information resources and databases provides new opportunities for the formation of knowledge based communities.

Online forums (such as Cybermetrics) have the potential to bridge gaps and unite geographically dispersed scientists, creating communities based on digital media. However, the relationship that researchers maintain with the history of their field is also expected to change; researchers' perception of their field (and its history) may become increasingly dependent on an ever expanding reservoir of ICT-mediated scientific content. The availability of email archives, pre-print servers and online databases affects the formation of field identities by creating a bias towards the traceable information captured in these new media (Heimeriks 2005). In a world where knowledge and information are paramount, researchers need new skills to adapt to rapidly changing environments. Not just digital literacy

and e-skills in itself are becoming essential, but also the more tacit skill of "reflexivity" is increasingly crucial.

The availability of digital information resources and databases creates more need for the researchers to be reflexive about the value of information, how it can be recombined with other information, in which context the information is meaningful and how it could be processed, stored, communicated and analysed (Heimeriks and Vasileiadou 2008). ICTs, also have the potential to fragment interaction and divide groups by leading people to spend more time on specialized interests and by screening out less preferred contact (Van Alstyne and Brynjolfsson 1997). Consequently, both 'informationally' and 'socially', researchers need to be more reflexive in order to be successful, thus giving rise to new dynamics of social and intellectual organisations.

In his latest book "The Knowledge-Based Economy: Modeled, Measured, Simulated", Loet Leydesdorff not only provides a challenging conceptual framework for understanding the self-organization of the knowledge-based society, but he also demonstrates how the knowledge base of society can be operationalized, both in terms of measurement and by providing simulation models.

The central thesis in Leydesdorff's analysis is the idea that knowledge production increasingly provides a coordination mechanism to the social system in addition to the control mechanisms of market dynamics and political governance. The knowledge base is the second order (reflexive) interaction among the first order interactions between the coordination mechanisms. Consequently, within the triple helix of University, Industry and Government relations there are three functions operating upon each other, control, market dynamics and knowledge production that support the emergence of the reflexive knowledge-base.

This idea of three interacting communication systems provides the starting point for theoretical and empirical elaboration. Luhmann was the first to propose that communications provide frame of reference distinct from agency (Luhmann 1984). He argued for analyzing society as complex and functionally differentiated by considering the human agents as the environment of the organisation of communication systems. Building on these concepts and on his previous work, Leydesdorff describes the processing of meaning from this communication theoretical perspective. This perspective entails several interacting levels; In the first place, social processes can be seen as the exchange of information between networked agents. Meaning can be attributed to the information that is exchanged. This meaning processing is distinct from (but interactive with) information processing. Meaning is provided to observations from the perspective of hindsight, while information processing follows the time axis. The meaning that is attributed to information can also be communicated in the network of agents. The recursive selection of meaning can give rise to codified (scientific) discourses. Globalization provides an additional mechanism to the social system, one which can be accessed by individual reflexivity. This reflexivity enables incursive dynamics in communication by updating expectations from the perspective of hindsight. Under certain circumstances, the evolutionary emergence of a global perspective can begin to drive the historical development of a social system into a self-organizing mode.

By using a simulation model of anticipatory systems, it is possible to show how an observer can be generated within an information process and how expectations can be communicated. An anticipatory system can be defined as a system which accommodates a model of the system itself. This enables social systems to reduce uncertainty by using the time axis as a degree of freedom; an anticipatory system can articulate possible future states of itself. Dubois (1998) has called this process 'incursion' to distinguish it from 'recursion' which follows the time axis. The knowledge base is specified in the simulations as a strongly anticipatory (sub)dynamic that can be expected to operate within an economic system, but to variable extents. Leydesdorff shows that a strongly anticipatory system can reconstruct its next stage which may lead to techno-economic co-evolutions.

Applying the model of reaction-diffusion mechanism, Leydesdorff also explains how we can understand phase transitions in social systems when new communication media are introduced. From this perspective, cultural evolution can be considered as including a hypercycle of the social system. The incursive reflexivity can be organized at the social level and give rise to a globalizing knowledge based society. As governance and industry becomes increasingly anticipatory, a knowledge based economy emerges as an interaction effect among institutions and functions. The resulting Triple Helix configurations of interactions between companies, universities and government, can be measured as network

data.

One unique perspective elaborated in this book is that it treats the emergence of a knowledge base of the economy as an additional degree of freedom to the complex social system. Leydesdorff argues that it is the emergence of a knowledge base that requires explanation rather than the consequences of knowledge based developments. The discourse of evolving communication systems may be less developed in the English speaking world (Incidentally, Leydesdorff's book provide the collection of theories and techniques to model, measure, simulate and understand this phenomenon). As a consequence, the vocabulary and intellectual tradition of which this book makes use, could be less accessible to scholars and policy makers engaged in the discussions on the knowledge based economy and globalisation. Nevertheless, the book is a major contribution to the debate for several reasons. In the first place, it provides a rich elaboration of empirical and methodological tools to understand the knowledge based society. In the second place, the book provides many challenging theoretical ideas. One of the fascinating theoretical contributions of Leydesdorff is that he explains how the ideas derived from (partially) conflicting perspectives provide potential for the generation of new knowledge. Leydesdorff enables the reader to put perspectives into perspective. In a fragmented reality comprised of different angles of reflection, it is likely that more than one perspective becomes codified in a scientific discourse. For example, while evolutionary economists are interested in the dynamics of evolution over time, the neo-classical approach emphasises the process of equilibrium seeking market-mechanisms at each moment in time. Additionally, the evolutionary mechanism of change can be distinguished from a historical one such as in social studies of technology and actor-network theories.

Cybermetrics, the quantitative study of the communication of information and meaning through ICTs, contributes insights concerning knowledge production and control in society that are amenable to measurement and simulation. This opens up opportunities for mapping how knowledge can have a different value to various audiences and how the possibilities for further communications can be interfered by an unexpected feedback as Leydesdorff has demonstrated. Furthermore, ICTs have opened up new possibilities for generating concepts and ideas that remain traceable and visible to an extent that was previously unthinkable. The changing interface between science and society and the co-evolution of ICTs and reflexive awareness of the contextual value of knowledge in a complex society, provide a complex challenge to cybermetrics. This book will be of enormous value to anyone wishing to contribute to our understanding of the knowledge based society.

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