The Industrial Cluster as a Complex Adaptive System

Enzo Rullani

Abstract. In the economic debate of recent years, the rediscovery of *industrial clusters* is concurrent with the rediscovery of *complexity*.
And with good reason.
These two issues regained popularity at the same time, after years of neglect, because they both underscore, in different ways, the failure of the idea of modernity derived from Fordism and the need for a new vision in which reason is unshackled from the *deterministic prejudice* that results from the extraordinary success enjoyed until now by a system based on the control of technology and financial success. *Neo-modern* reasoning, or post-modern reasoning, as some prefer to call it, should salvage the worthwhile aspects of modern tradition - rational criticism, dialog communications and universalism of values and rights - integrating these values with an attitude that is more open to the *exploration, interpretation and invention* of possibilities that, while outside our control, can be important and yield the benefit of a rational exploitation of what we already know and control (Rullani 1996).
The notion of modernity that shaped the imaginary edifice of Fordism was the expression of a *deterministic reasoning* that sought to *exploit* to the fullest what was already known. The step that is being proposed today, which brings complexity back into play, is to develop alongside this line of reasoning another one, more dangerous but more promising, based on the *exploration* of the world of possibilities (Axelrod and Cohen 1999, p. 43).
According to J. March (1991, p. 71):

> "exploration includes things captured by terms such as search, variation, risk taking, experimentation, play, flexibility, discovery, innovation. Exploitation includes such things as refinement, choice, production, efficiency, selection, implementation, execution".

In order to govern complexity, we must explore and capture what is new, but also exploit the results of what has been learned each time. If we were to just explore, we would have to bear all the costs of the activities needed to research, interpret and test that which is new, but we would reap only a fraction of the benefits that could be obtained from the resulting innovations. The choice of focusing only on exploitation, with a minimal interest in exploration, would be equally unsatisfactory, because if we were to limit ourselves to exploiting rationally what we already know, we would find ourselves trapped in some sub optimum equilibrium zone from which we could not escape even if we were confronted with exceptional opportunities.

A. Q. Curzio et al. (eds.), *Complexity and Industrial Clusters*
© Physica-Verlag Heidelberg 2002

Between exploitation (of what is known) and exploration (of what is new) there is a border that neo-modern reasoning must cross over repeatedly as it seeks useful opportunities, without ever stopping at that methodological borderline beyond which is a land that until a short while ago was marked "Danger! Unknown".
The relationship with complexity - and, as it concerns us here, with industrial clusters - brings into relief a basic alternative between rationalizing that which is old and exploring that which is new one that all systems of learning must face sooner or later and that, not accidentally, represents a "place" (*topos*) that is typical of the more general studies of complexity (Holland 1988, 1995).
During the past century, when deterministic reasoning was prevalent, the focus was primarily on computing and optimising what was already known, reducing the exploration of that which was new to a routine that administered and controlled all innovative acts, neutralizing their subversive energy. In this sense, the century of Fordism was characterized by *hostility to complexity*, which was seen as a source of uncertainty and risk and, therefore, an obstacle to rationalization. Increasingly codified and rigid forms of *forecasting, planning and control* were developed in order to minimize the exposure to complexity, which artificially reduced opportunities and interest in exploring that which is new. In both theory and practice, the emphasis was on rationalizing that which existed by relying on bureaucracies and automatisms. Complexity was tackled by breaking it up into fragments and forcing these fragments into predetermined computation (technology, markets), control (plans) and negotiation (management) procedures.
To do this, economic behaviour, which could be put through computation and optimisation procedures more easily than other activities, was separated from everything else. Economics became the science of efficiency, specialized in exploitation and removed from exploration. Its complexity was drastically *reduced* by assigning all its anthropological, social and institutional variables to the realm of *exogenous* variables, which left economics with just one task: maximize the efficient use of known means to achieve equally known ends.
In this context, the *territory* was inevitably pushed to the margins of economics studies. Since it is an elective place where economics, society and history intersect, the territory contains information and complex relationships that exceed the sphere of calculable actions. One could even say that thinking in the past century, because it was consumed with reducing complexity, was ultimately also an *enemy of the territory*, which was perceived as a system that creates, preserves and reproduces the complexity of history and experience.
The reason why we are now re-examining with such great interest industrial clusters and other local phenomena that are rooted in geographical locations and are rediscovering old studies of territorial economies that were gathering dust in local archives is because we need to understand how to tackle high levels of complexity without first breaking it down with computations, controls and negotiations, since time has shown all these methods to be blunt and increasingly ineffective instruments.
The *rediscovery of complexity entails the rediscovery of the territory* and vice-versa. Choosing to take a *pragmatic*, experimental approach that allows rationality to explore the open world of possibilities also means finding a foothold in the