Schumpeter's legacy and evolutionary economics

Schumpeter's writings leave many questions unanswered. Is economic development inherently cyclical? To what extent is the periodicity of long waves pre-determined? How do clusters of innovation emerge? Which policies can governments adopt to influence the way in which the transition from one wave to the next unfolds? The 'neo-Schumpeterian' school of research – or evolutionary economics, which is the term preferred by its main protagonists – has emerged to answer these and other questions, with *An evolutionary theory of economic change*, published by Richard Nelson and Sydney Winter in 1982, regarded as its seminal work (Arena and Lazaric 2003). Other prominent researchers working within this tradition include Giovanni Dosi, Christopher Freeman, Bengt-Åke Lundvall, Mariana Mazzucato, Keith Pavitt, Carlota Perez, Mario Pianta, Nathan Rosenberg and Luc Soete.

The concepts developed by evolutionary economists include systems of innovation and technological trajectories. A system of innovation, defined at national or regional level, is a network of institutions and actors in the public and private sectors who interact in producing, adapting, diffusing and using the new knowledge and new technologies which contribute to social and economic development. This is a broader concept than the Schumpeterian cluster, since it also incorporates those who play a role in innovation and the social relations which emerge between them. A technological trajectory retraces the history of a group of innovations with its associated twists, turns and forks in the road, dead ends and fresh starts, and demonstrates that technological innovations are always path-dependent – a path shaped by the interactions between economic, institutional and social stakeholders.

A 'post-Fordist' revival implies the need for a new mode of growth based on a techno-economic paradigm.

A number of authors working in the field of regulation theory have also drawn inspiration from evolutionary thinking, particularly in their analyses of the Fordist mode of regulation which is the hallmark of the 1945-1975 period of prosperity. The downfall of Fordism from the 1980s onwards can be interpreted as the decline of the techno-economic paradigm which shaped this period of prosperity (Boyer and Coriat 1984), and the very idea of a 'post-Fordist' revival implies the need for a new mode of growth based on a techno-economic paradigm newly forged from controversy and upheaval (Boyer 2002). Before going any further, however, we must define exactly what is meant by the term 'techno-economic paradigm'.

From long waves to techno-economic paradigms

Instead of focusing solely on a deterministic succession of long waves, evolutionary economists prefer to ascribe more importance to the tensions and political choices which appear during periods of transition by thinking in terms of techno-economic paradigms; these are defined as patterns of

continuous socio-economic development, with transitional phases ('technological revolutions') separating one paradigm from the next. The concept emerged in Brighton (Science Policy Research Unit, SPRU) and Maastricht (Maastricht Economic Research Institute on Technology, MERIT) from the 1980s onwards, with its most prominent advocates including Christopher Freeman, Luc Soete and Carlota Perez.

The transition to a new techno-economic paradigm stems from the convergence of several new technology systems, which act as vectors for multiple radical innovations that, in turn, give rise to structural changes in the global economy and the emergence of new social and institutional frameworks. The transition ultimately transforms the conditions and means of production, labour organisation, the labour market, channels of distribution and the way that people live their lives, and the new paradigm is diffused through the whole economy; the conditions under which this diffusion takes place are determined by political choices, social relations, the strategies adopted by economic stakeholders, how the labour market works and whether society's institutions manage to adapt. The technologies themselves determine neither the end nor the duration of the transition in advance.

Technologies determine neither the end nor the duration of a transition, which is the outcome of their convergence with structural changes in the economy, society and institutions.

Freeman and Soete published research in the 1990s referring to the current transition as the establishment of a new paradigm based on information technologies and networking, the development of a knowledge-based economy, a shift in collective service needs and a reconfiguration of social relations (Freeman and Soete 1994; Freeman and Louçã 2001). This new paradigm replaces one based on cheap oil, the automation of high-volume production, the mass distribution of consumer goods and services, the boom in the chemical, aerospace, electronics and audio-visual sectors and a general increase in well-being in developed countries (the Fordist mode of growth, in other words).

Each paradigm differs in terms of the way in which the majority of companies are organised, the way in which social compromises are negotiated and the way in which international trade is structured. During the period of prosperity in the late 19th and early 20th centuries (the '*Belle Époque*'), business owners focused their efforts on large mechanised factories, particularly in the textile and heavy industry sectors. Mechanisation shaped the social and technical division of labour, social relations were characterised by inter-class conflicts and the appearance of an organised workers' movement, and colonisation globalised trade relations in a wholly novel way. During the 1945-1975 period of prosperity, the preferred vehicle for doing business was the Fordist company, based on the principles of mass production and consumption, economies of scale, automation-related productivity gains and a pyramidal hierarchy. It was Taylorism and automation which shaped the social and technical division of labour during this period, and social relations were characterised by the building of compromises between employers and trade unions and by a new dialectic

of cooperation and conflict. The new face of globalisation was that of a multinational company, following the example of the behemoths of the oil, electronics and automotive sectors. The following paradigm, based on digital technologies and networking, will truly take hold only once new ways of organising businesses and workers, achieving social compromises and institutionalising international trade, become generally accepted.

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The new paradigm will not replace the previous one immediately or completely, however. The transition may stagnate as a result of the tardiness and timidity of the institutions called upon to make changes, and their tendency to remain trapped in short-sighted strategies, even as the pace of innovation appears to be speeding up. A useful document to revisit in this connection is the report drafted in 1997 for the European Commission under the guidance of Luc Soete, entitled *Building the European information society for us all* (Soete 1997). As well as calling for the information society to have a social dimension and criticising EU policies for their failings in this respect, the report sets out a number of recommendations which demarcate the institutional changes which must be made as part of the transition towards a new paradigm, in areas such as the dynamics of innovation, education, the renewal of public services, the quality of jobs, social inclusion and cultural diversity. Were it published today, a more suitable title for this report might be *Remembrance of Things Past*.

Refined and updated evolutionary theories

The concept of the techno-economic paradigm has most recently been refined by Carlota Perez (Perez 2010), an intellectual heir of Christopher Freeman who is particularly interested in the unique role of speculative bubbles and financial crises in the development of techno-economic paradigms ('great surges', to use her terminology), and who has reinterpreted the periodicity of these great surges and the transitions between them, as summarised in Figure 2. Roughly speaking, the great surges described by Perez extend from the peak of one curve to the peak of the following curve, whereas neo-Schumpeterian waves extend from one dip to the next (as shown in Figure 1); Perez also dispenses with the idea of ascending or descending phases and replaces it with the concept of a growth regime.

What is innovative about this approach is the succession of installation periods, turning points and deployment periods in each great surge. The installation period is characterised by a triggering event and a phase during which new technologies emerge and transform the systems of innovation, followed by a period of bubbles, mania or even frenzy, typified by innovations which represent a departure in every sense of the word. The pace of innovation accelerates thanks to a context of financial speculation and market deregulation in which the States become ever weaker as they