

Mokyr (2002) points out that income growth in the twentieth century would not have taken place without technological changes, which are underpinned within more democratic countries. Kuznets (1965) writes that modern economic growth is based on the growth of the stock of useful or tested knowledge. Moreover, Mokyr (2002) claims that the failure of technological progress in the pre-1750 environment to generate sustained economic growth is due to institutional negative feedback. In fact, before the civil war in England, the French revolution and democratization wave diffusion (Kurzman, 1998), the social and environmental conditions to sustain worldwide technological progress are not present. The civil war in England (1688), the revolution of the American colonies (between 1775 and 1783) and the French revolution (1789–1799) generated a variety of social and political forces that led to the exploiting of several techniques (since 1800s) based on path-breaking classical inventions such as the steam engine. Mokyr (2002) also argues that scientific revolution and the Enlightenment [within most free and high democracy countries] helped expand the epistemic base of techniques in use and thus created the conditions for more sustainable technological progress. In order to support this process, the Industrial Revolution requires not just new knowledge but the ability of society to access this knowledge, use it, improve it, and find new applications and combinations for it. As Headrick (2000) emphasizes, the age of industrial revolution through a variety of technological as well as institutional innovations did exactly that, thanks to a new political and social climate within more democratic countries. Had the institutional feedback been negative, as it had been before 1750, technological progress would have been on the whole short-lived. Yet the feedback between institutions and technology was and is positive. As a matter of fact, the years after 1815 were more and more subjugated by the free market liberal ideology which provides

incentives for scientific and entrepreneurial behaviour within more democratic countries.

Moreover, since the democracy of European countries as well as of the United States of America was, before 1815, at an early stage, innovations had minor effects on economic growth, real wages and living standards. When the democratization processes of countries entered a steadier state, another wave of innovations created – in a more global and democratic Europe – a new economic wind which, after the 1850s, increased productivity growth, income per capita and real wages. *This was a period of unprecedented growth, and achieved triumphs ... equal, if not superior, to all centuries combined* (Smith, 1994). The co-evolution of democratization and technical change has been assuming new forms in the current economy and the most important development is the Information and Communication Technologies Revolution (Devezas *et al.*, 2005). As a matter of fact, the Third wave of democratization (1980s-1990s) generated a receptive political and economic environment to absorb a new techno-economic paradigm and the benefits of converging technologies (Freeman and Louçã, 2001).

This historical discussion confirms that the democratization process underpins technical change and is prior to technological progress as well as economic growth (Figure 2).

Marchetti (1979) and Ayres (2005) consider the importance of energy as a driving force of economic growth and of Kondratieff waves (K-Waves or long wave dynamics). I actually assign a fundamental role to democratization, which is also an antecedent process to the use of energy resources and energy conversion as well as technology, economic growth and K-wave dynamics. For instance, some countries in Eurasia, which have the majority of the world's known energy resources, without democratization cannot research and develop technology, absorb it and follow economic growth patterns.