

Technological trajectories

Technological trajectories can be defined as the paths by which innovations in a given field occur. The emergence of technological trajectories can be explained by the interplay between scientific advances, economic factors and institutional variables (Dosi, 1982).

Technological change is cumulative and path-dependant, influenced by the prevailing technological paradigm and the evolution of technological trajectories. Thus technological change can get 'stuck' or 'locked-in' within one trajectory, which would potentially lead to sub-optimal results. For example, when the market is reinforced by network externalities among previous adopters, the development of a new technology, even if superior, can be irrelevant to the system which prevails. Thus it is important to consider the factors that determine when a technology will lock-in into a trajectory, how a technology may break-out of a lock-in, and how competing technologies may co-exist in a balance. Another factor leading to potential "lock-in" is potential social obstacles to technological change particularly if it is discontinuous (i.e. if it leads to the emergence of a new technological paradigm). Such changes face social obstacles because, beyond shifts in underlying knowledge, the transition to a new technology also entails changes in user and managerial practices, organizational structures, industrial networks and regulations, as well as a cultural adaptation to the logic of the new technologies involved. These impose diverse benefits and costs on different actors in the innovation system.

Research has found great variety of technological trajectories in different historical periods and industrial settings. Indeed, industries differ in their underlying technologies, historical patterns of development and skill requirements. Some studies have analyzed how technological trajectories evolve differently across different sectors using Pavitt's taxonomy (Castellacci, 2008; Tidd and Bessant, 2009). In 'science-based' sectors (e.g. chemical, pharmaceutical and electrical and electronic engineering) technological change emerges mainly from corporate R&D laboratories and is heavily dependent on scientific knowledge, skills and techniques emerging from academic research. In 'supplier-dominated' sectors (e.g. agriculture, textiles, traditional manufacturing) technological trajectories are determined almost exclusively by the suppliers of machinery and other production inputs. In 'scale-intensive' sectors (e.g. extraction and processing on bulk materials, automobiles, large scale civil engineering projects), technological accumulation is generated by the design, building and operation of complex production systems and products, where the main sources of technology are in-house design and production engineering departments, operating experience, and specialized suppliers of equipment and components. 'Specialized suppliers' (e.g. small mechanical and instrumental engineering, and software firms) produce innovations for use in other sectors, and technological change in these sectors focuses on learning from advanced users and matching new technologies to users' needs. Technological trajectories initiated in a given industry may spawn to other existing or new industries and drive their evolution even more importantly than that of the original sector where they emerged. For example, current progress in the field of rechargeable batteries is being driven mainly by the mobile-phone, tablet and laptop industries, but the advances could eventually have a more radical impact on a different industry such as electric vehicles.

References

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