Angelo Bonomi (2023), *Technology Innovation: Models, Dynamics, and Processes*, CRC Press, London, Taylor & Francis, 139 p.

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ARTICLE

Whether progressive or radical, technology innovation is not only the result of, but also an integral part of, a complex process characterized by numerous reactions and interactions. Innovation as a process is systemic (Uzunidis, 2020). 1
Upstream, technology and the innovations associated with it form a dynamic system made up of specific, diversified skills. By acquiring, mobilizing, and combining these skills, the innovation actor (entrepreneur or organization) creates technological resources and modifies the relationships it maintains with its environment, but also modifies the internal operations involved in the development and application of a given technology. Hence the importance of studying the relationships intrinsic to this technological system, as well as the way in which it acquires new knowledge resources in order to evolve. The analysis of innovation processes from the point of view of scientific and technical interactions within and in relation to technology is presented and modeled by Angelo Bonomi in *Technology Innovation: Models, Dynamics, and Processes*.

The author holds a PhD in industrial chemistry from the University of Milan. Since 2013, he has been collaborating as an associate researcher at IRCrES; the research institute for sustainable economic growth of CNR, the Italian National Research Council, carrying out studies on technology innovation and territorial innovation systems. His engineering skills, combined with his experience as a researcher in the field of 2

technological development processes and the resulting innovations, have led him to reflect in depth on the models, dynamics, and processes of technology innovation. The importance and novelty of his reflections lies not only in explaining how new technologies are developed, but also in thinking about technology innovation in a new way, with a view to revealing its fundamental nature. To this end, the author considers technology as a physical phenomenon producing an effect that can be exploited for human purposes, and new technologies as a combination of pre-existing technologies. According to his approach, it is possible to study technology as an autonomous discipline, independent, in the first instance, of economic or social factors. A. Bonomi emphasizes that this approach, independent of industrial, economic, or social factors (to which he devoted a previous book, Bonomi, 2020), enables us to describe the hidden or poorly considered structures and processes that characterize technology and its innovation, such as know-how and technology transfer.

3 The book is divided into four parts. In the first part, the author discusses the nature of technology and its scientific definition. He then builds a model of technology and its innovation as the result of the activity of structures organizing flows of knowledge and capital. The second part is devoted to the relationship between technology innovation and other types of innovation, the importance of complexity science in describing the concept of technology innovation, processes, models of technology and its innovation, and the relationship between technology and the environment. The third part contains an application of the model to describe the operation of a technology and its optimization. Modeling can also be used to explain the functioning of a technology innovation system in a specific area. In the concluding fourth part, the author presents some prospects for the evolution of the technology innovation system, the future of new technological sectors with significant development potential, and discusses some intrinsic dangers of technological evolution.

4 The theoretical model of technology and technology innovation presented in the book considers technology as a structure of operations, each characterized by a set of parameters assuming various possible values or choices. To obtain and choose a satisfactory technology, different parameters are applied and choices are made within and between these parameters, resulting in technological recipes. All these recipes for a given technology constitute the technology space. If we add a technology efficiency value to each recipe in the technology space, we obtain a technology landscape. Learning by doing can then be seen as the search for an optimal recipe in the landscape, and innovation as a change in the operational structure of a technology. The model enables us to assess the degree of radicality of a new technology resulting from an innovation process, compared with a pre-existing technology. The degree of radicality is represented by the distance between these technologies in the technology space: radical when distant; incremental when close.

5 Technological processes can take place within the framework of a single technology or can involve a set of technologies. They can be understood in terms of the technology landscape or technology space. For example, the "externality" of a technology is represented by the influence of external factors, such as changes in raw materials, costs, regulations, equipment failures, etc., on the effectiveness of a technology, thus modifying its technological landscape, leading to the process of finding new optimal conditions in the modified landscape through learning-by-doing. On the other hand, the "intranality" of a technology corresponds to the fact that, when the operational values of a parameter are modified to improve the efficiency of an operation, this modification can influence the efficiency of other operations and therefore the overall efficiency of the technology; this requires adjustments and a new parameterization of operations.

6 The technology space becomes denser through the "ramification" of an initial radical technology. This can generate other technologies, leading to a diversification or improvement of the initial technology. In this way, the degree of radicality of the technologies formed decreases with the development of ramification, while the number of ramified technologies increases. This ramification can be studied through the generation of patents from an initial radical technology. The process of technology ramification indicates the importance of intermediate scientific and technical education for a country's economic growth, since ramification depends primarily on the technical activities carried out during the use of a technology.

7 Thanks to the model constructed by A. Bonomi, other key phenomena linked to the birth and diffusion of technologies can be analyzed. These include, for example, the speed of formation of new technologies, which depends on the changes in operations that are deemed necessary to obtain the right structure for the new technology. In this case, it is to be expected that during the development of a project, the technology associated with it may become obsolete before it is realized through the advent of an innovation. With regard to technology transfer, the author points out that there are two different technological processes: the first concerns the implementation of a new technology, the second is the transfer of a technology to another location. An essential aspect of technology transfer is the acquisition of the know-how required to exploit the transferred technology. The technology model can provide a description of the nature of know-how, which consists in the accumulation of experience by the operator in modifying the parameters of a technology to maintain its efficiency in the face of the recurring effects of the technology's "externalities" and "intranalities"; hence the difficulty of transferring technology from one socio-technical system to another (see also Bonomi, 2021a). Engineering and learning-by-doing play an important role in adapting transferred technology to local conditions. In this case too, there can be no transfer without innovation.

8 In conclusion, it should be noted that for the author, technology can be considered and modeled as a time-oriented structure of operations, and technology innovation can be seen as a change in this structure. The change in the structure of a technology occurs in structures organizing the flow of knowledge and capital for the generation of new technologies. These structures are a) the traditional system of industrial R&D projects (where technological development is organized and planned), b) the startup venture capital (SVC, in which start-ups not only carry out R&D but also develop business models adapted to the technology developed, and where venture capital finances the sale of technologies) and the system of industrial platforms (within which platform owners, producers and consumers of technologies exchange information, develop new knowledge, and thus contribute to the birth and diffusion of innovations). Industrial platforms integrate and combine different organizational structures. Their future success depends on the availability and reliability of digital infrastructures, such as the Internet, big data, and cloud computing (Bonomi, 2021b).

9 Could we imagine the future of operations linked to technology innovation (and therefore future industry) in an ecosystem dominated and organized by digital technologies and applications? Here is the author's astute answer: a possible large-scale diffusion of industrial platforms could disrupt current R&D and innovation systems, as companies could satisfy their innovation needs by establishing links with many different platforms, active in the different types of technologies they need, while producers could propose innovations to many platforms. In this case, platforms become concentrators and disseminators of an enormous amount of knowledge that stimulates the generation and improvement of new technologies (see also, Leiting *et al.*, 2023). From this perspective, the question of intellectual property is then crucial (Pénin, Neicu, 2018).

10 The author undertakes the theorization of technology innovation systemics through an approach that can refer to the etymology of technology: science of techniques. The organization of technology in society guides the dynamics of its evolution. Does the current technological system have the capacity to generate powerful innovation movements? This is a book of high added value in the field of innovation studies.

Bibliographie

References

BONOMI, A. (2020), *Technology Dynamics: The Generation of Innovative Ideas and Their Transformation into New Technologies*, CRC Press, London, Taylor & Francis.

BONOMI, A. (2020), Theoretical Model of Technology for Innovation, in Uzunidis, D., Kasmi, F., Adatto, L., *Innovation Economics, Engineering and Management Handbook: Main Themes*, London, ISTE/Wiley, 363-370.

BONOMI, A. (2021b), Modern Innovative Organizational Structures, in Uzunidis, D., Kasmi, F., Adatto, L., *Innovation Economics, Engineering and Management Handbook: Main Themes*, London, ISTE/Wiley 251-257.

LEITING, T., KÜLSCHBACH, A., STICH, V. (2023), Development of a Platform Business Model for Co-creation Ecosystems for Sustainable Furniture, *Journal of Innovation Economics & Management*, 202340(1), 81-107.

PENIN, J., NEICU, D. (2018), Patents and Open Innovation: Bad Fences Do Not Make Good Neighbors, *Journal of Innovation Economics & Management*, 25(1), 57-85.

UZUNIDIS, D. (ed.) (2020), *Systemic Innovation: Entrepreneurial Strategies and Market Dynamics*, Smart Innovation, London, ISTE/Wiley.

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