

# TECHNOLOGY, STRUCTURAL CHANGE AND LONG-TERM FLUCTUATIONS\*

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Coming from an applied institute with a certain methodological orientation, and being innovation biased, due to my past interests, I will attempt to base my brief contribution on the relevance of some of the views and questions that have arisen in innovation research and in the course of the activities of our collaborators to the issues of long-term fluctuations in economic growth. The applied character of our institute has both advantages and disadvantages, particularly in connection with the topics of the Workshop, since we can not avoid also being, at least in part, future oriented, which is not always a rewarding exercise.

## Reassessment of Past Innovation Research

The timing of generic innovations and the proof of their swarming is of significance for research on long-term fluctuation, but the dynamic effect of innovation on the economy is mediated through innovation diffusion. Recently, however, several researchers (Freeman, 1986; Brooks, 1985; Gold, 1986; Rogers, 1986), have indicated that past innovation diffusion studies were pro-innovation biased (it was assumed that innovation should and would be applied widely and rapidly, and would not be rejected or re-invented, etc.) and very often

- dealt with particular forms of innovations only, therefore some generalizations led to an overinterpretation of results (lack of complexity),
- were biased by the particular characteristics of the branches studied (lack of transferability of results across branches),
- ignored the particular (temporary) economic conditions prevailing during the period of the study (lack of transferability forward and backward in time).

The drawbacks of some past studies became particularly visible when attempts were made to apply their results to new economic conditions (for example, economic stagnation or decline).

Several tacit assumptions proved to be not as generally valid as had previously been taken for granted. Examples of such assumptions that were not confirmed by practice are:

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\*Revised version.

- that homogeneous economic and other effects of a specific innovation are spread across the economy,
- that successful initial applications are a guarantee for prompt adoption throughout an industry,
- that managerial criteria for evaluating technological innovation for adoption can be derived from general economic logic,
- that it is possible to identify, in advance, the effects of specified technological innovation on the economic performance of the firm or industry.

It is considered the task of researchers to study the potential diffusion patterns of key technologies with these restrictions in mind, if the research is to have more relevance for the practice.

Despite the fact that the diffusion of innovation along technological trajectories is conditioned by specific economic forces it is worth mentioning, but hardly a surprise, that most developed countries have already, more or less selected, the same technologies for securing future development. These technologies are believed to add-up to a future technological system as a base for economic growth. For example, in December 1985 the Socialist countries (CMEA) approved the five "directions" of technology listed below as a part of a "comprehensive program of scientific and technical progress":

- "electronization" of the national economy,
- robotization and flexible manufacturing,
- nuclear energy,
- new materials, their production and processing,
- biotechnologies.

Through the new technologies and a new management system the socialist countries expect to regain the higher economic growth rates, and in two to three decades to double the current productivity of labor.

In Western countries similar technologies have been singled out as components for future technological systems that should lead to the next long wave in economic growth. By way of illustration, I would like to refer to the 1985 NSF Conference on Industrial Science and Technological Innovations that considered the same technology directions (with the exception of nuclear energy).

One can accept or reject the Schumpeterian hypothesis of technology-driven economic development and the idea of a resulting long wave, but because some governments have already made their decision, and are supporting the aforementioned technologies in applied