

Chapter 16

Morphological Analysis, Diffusion, and Patterns of Technological Evolution: Ferrous Casting in France and the FRG

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16.1 Introduction

The historiography of technical change has demonstrated that the process of technological diffusion is in itself also a developmental process. In other words, it is in its diffusion throughout the economy that a technology acquires its industrial and economic properties, transforms itself, and widens the initial market in which it was adopted. On the basis of these dynamic properties of the diffusion process, some authors have been hasty in inferring the theoretical impossibility of formal representation, since the objective of the diffusion is not the same at the beginning, in the middle, and at the end of the process. It appears to us, however, that the interest in a formal

representation resides precisely in the possibility of periodizing the diffusion process, with the aid of criteria that can take into account the principal transformations of the technology under consideration. The diffusion process can thus be considered as a series of competitions at given times between a technology A, which is in the middle of a transformation, and other technologies (B, C, and D) with respect to those functions that A is successively able to assume. Generally these successive competitions will occur in ever larger markets as A progressively enlarges its initial functional characteristics. It is therefore possible to interpret the characteristics of the diffusion pattern of a given period on the basis of the manner in which competition developed throughout a previous period.

The first part of this chapter consists therefore in a complete and comprehensive morphological analysis (MA) of a set of (process) technologies for a particular industrial activity, in this case ferrous casting. Through the MA approach proposed, we will be able to define the criteria of the periodization of the diffusion process for the technology under consideration. More generally, we intend to show the importance and fruitfulness of an explicit and formal methodology in defining the technologies competing/diffusing in a particular market, which by its comprehensive nature, is not time-dependent or results simply from the aggregation level available in industry statistics.

In the second part we use the results of our MA of the technological trajectories in the casting industry to analyze their diffusion in two countries, France and the Federal Republic of Germany (FRG). We first describe the very different patterns of the technological trajectories in the two countries. We then continue to discuss the possible driving forces behind the *locking-out* of the gasifiable pattern process technology (GP process) in France and its diffusion in the FRG, followed by a quantification of the diffusion process based on standard diffusion methodology. This will be based on a simple Fisher-Pry (1971) type of technological substitution model. On the basis of the MA we describe the diffusion of the GP process as proceeding by successively filling two market niches: first, small batch-size production and later, following improvements in the technology, also mass production of ferrous castings. In the case of the FRG we point out the extreme importance of the early start of the diffusion process of the GP process technology inside a small initial market niche, which generates a process of accumulation of knowledge and learning (this was not the case in France) leading to the widening of the initial market niche.