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- Antitrust Revolution: Economics, Competition and Policy*, 4th ed., edited by John Kwoka and Lawrence White, 476–501. New York: Oxford University Press.
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Comment Giovanni Dosi

The chapter insightfully analyzes two instances of “Schumpeterian transitions” across different technological trajectories, and the vicissitudes of the firms that were market leaders on the “old” ones. As such, it makes fascinating reading in its own right. But it is also a revealing illustration of some of the major advances made over the last half century, since the early Rate and Direction Conference, in the understanding of the nature and dynamics of technological knowledge and the conditions under which it is generated and economically exploited.¹ It is from this angle that I will offer the comments that follow.

In fact, together with the understanding of the determinants of the rates and directions of accumulation of technological knowledge, a lot of progress has been made in the understanding of business firms as major repositories

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1. For an overview of the state-of-the-art in the field, let me refer to Dosi and Nelson (2010).

of such knowledge. Actually, while in earlier eras much of the inventing was done by self-employed individuals, under modern capitalism business firms have become a central locus of efforts to advance technologies. Firms have long been the economic entities that employ most new technologies, produce and market the new products, and operate the new production processes.

Opening up the “organizational blackbox” has led to the acknowledgment of the (rather idiosyncratic) capabilities firms embody, not only concerning technological and manufacturing knowledge, but also marketing, interacting with users and suppliers, and the very practices of internal governance of the organization.² Deeply complementary to the analyses of innovative activities focused on dynamics of knowledge, artifact characteristics and input coefficients, capability-based theories of the firm have begun addressing the behavioral meaning of statements such as “firm X is good at doing Y and Z.” Relatedly, one has made significant progress in the study of the mechanisms that govern how organizational knowledge is acquired, maintained, augmented, and sometimes lost.

Organizational knowledge is in fact a fundamental link between the social pool of knowledge, skills, and opportunities for discoveries on the one hand, and the microefforts, directions, and economic effectiveness of their *actual* exploration on the other.

In these respects, the work by Bresnahan, Greenstein, and Henderson adds indeed two in-depth analyses of the features of organizational capabilities and their alignment (or lack of it) with particular market requirements.

Moreover, organizations embody broad “strategic orientations”—some-what metaphorically, the collective equivalent of “mental models”—also involving prescriptions and heuristics on how to adapt and change over time, in which markets to position, which technological trajectories to pursue, and so forth.³

Capabilities and organizational cognitive models contribute to shape the *coherence* of the organization also in terms of its horizontal and vertical boundaries (that is, patterns of output diversification and vertical integration).⁴

Moreover, capabilities and cognitive models map into specific (a) organizational architectures; (b) patterns of information flows, and (c) lines of command and distributions of political power within the organization. And indeed such mapping yields an ensemble of discrete combinations that may or may not be in tune with technological and market requirements. The

2. Again, for a more detailed discussion I must refer to other works (cf. Dosi, Nelson, and Winter 2000; Dosi, Marengo, and Faillo 2008).

3. All this roughly corresponds to what is referred to as the *dynamic capabilities* of a firm: cf. Teece, Pisano, and Shuen (1997) and Helfat et al. (2007).

4. For an early attempt to operationalize such notion of “coherence,” cf. Teece et al. (1994). Subsequent contributions include Piscitello (2004) and Bottazzi and Pirino (2010).

two examples discussed in the chapter, especially the IBM one, are excellent illustrations of the point.

Take the IBM case. Strong technological capabilities match a commitment to incrementalism in product architectures, cumulative learning, vertical integration, proprietary standards, coordinated strategic governance (through the Corporate Management Committee) and, on the market side, a reputation for postsale service.

This IBM model, Bresnahan and colleagues insightfully show, is well aligned to market requirements under the mainframe/minicomputer trajectories, but becomes *misaligned* to the requirements of effective production and marketing of personal computers. It is not that the raw capabilities are not there. They are. And in fact IBM even proceeds to a rather successful exploration of the new *combinatorics* between elements of technological capabilities, organizational setups, and market orientation well suited to the personal computer world. However, that very success accelerates the clash between the PC organizational model and the incumbent IBM (mainframe) model. The latter wins, and by doing that IBM ultimately kills its PC line of business.

It is a story vividly illustrating the path-dependent reproduction of capabilities, shared strategic models, and specific organizational arrangements. To repeat, it is not that IBM lacks any of the single elements underlying successful, “PC-fit,” combinations. It is just that capabilities, “visions,” and organizational setups are better understood at least in the short term as *state* variables rather than *control* variables, in Winter’s (1987) characterization. Of course, also state variables can and are indeed influenced by purposeful discretionary strategies; that is, by the explicit manipulation of control variables. However, this takes time and is tainted by initial birthmarks and subsequent historical paths the organization has followed with respect to both operational repertoires and higher level collective visions concerning the very *identity* of the organization. The topical reference is Nelson and Winter (1982) on organizational routines, but a vast literature has developed since.⁵ Interestingly, path-dependent reproduction of routines, strategic visions, and organizational memory might continue to be there—the IBM case in tune with the conjecture—notwithstanding turnover at the top level of management.⁶

Back to the IBM case. Was there an alternative to what actually happened?

Probably, in my view, there was, but most likely such an alternative would have massively violated the cognitive/strategic coherence of the organization: holding mainframes and PC together would have meant a sort of “IBM

5. For surveys and discussions on routines and other recurrent action patterns, cf. Becker, M. (2004), Cohen et al. (1996), and Lazaric and Lorenz (2003).

6. Some formal explorations on the features and performance implications of organizational memory are in Dosi et al. (2011).

Holding,” kept together primarily in terms of ownership but not of strategic management and coordination.

Is this the story that the chapter tells? Yes and no. The interpretation of the factual story, masterfully reconstructed indeed, has two layers.

The first one is in terms of economies/discontinuities of scope.

Let me introduce a little, but important, incidental. One of the motivations of our Teece et al. (1994) was precisely to go beyond the blackboxing involved in the standard account of product diversification in terms of economies of scope. In that, two products will be produced under the same organizational roof according to the sign of the inequality

$$c(x_1) + c(x_2) \geq c(x_1 + x_2),$$

possibly adding fixed costs, the same possibly shared by the two activities into the $C(\dots)$ functions.

In Teece et al. (1994) and subsequent literature, one tries indeed to explore what is behind the foregoing inequality. The interpretation of multiproduct “coherence” runs in terms of characteristics of the technological knowledge involved in the design and manufacturing of different products, the market characteristics for the products themselves, and, dynamically, the properties of the ensuing trajectories. At the level of single firms all this, to repeat, is reflected into idiosyncratic capabilities and their links with revealed organizational strategies.

The chapter, at the theory level, in a way undertakes the opposite interpretative strategy. It masterly tells a story of capabilities, organizational memory (including biases, blind spots, and inertial visions) but then it opts to squeeze the all story back into the much smaller and darker box of economies of scope. Maybe this is as much as the contemporary representative economist is able to understand, but I am not fully convinced of how big the interpretative value added to the exercise is at the end. In fact, such an exercise is not too far from any attempt to reduce all we have learned on production knowledge and its dynamics over the last half century into more sophisticated versions of some “production function.” In any case, let it be it. Or am I missing something?

Certainly my theoretical preference goes to constructive models whereby one tries to explicitly account for the problem-solving activities of organizations and their evolution over time (for still exploratory examples, among a growing number, see Levinthal [1997]; Siggelkow and Levinthal [2005]; Marengo and Dosi [2005]; and Dosi et al. [2011]). Indeed, the mapping of representations of business firms as ensembles of (cognitive and physical) problem-solving activities into a much lower dimensional space of input-output coefficients and related cost structures remains a daunting challenge, but one worth being taken up in my view.

Come as it may, I do find convincing the suggestion that the misalignment of capabilities, cognitive models, and market requirements between

two lines of product—say mainframes and PCs—entailed *diseconomies of scope*, even if I do not consider that the primitive level of analysis. However, the authors push their interpretation further, and, granted the presence of such diseconomies associated with necessarily shared assets, argue that the ensuing choice of organizational arrangements facing the Schumpeterian dynamics of emergence of new products and new technological trajectories is a *genuine choice* and quite a rational one indeed. Diseconomies of scope shaped managerial incentives, it is argued, ultimately leading to the observed outcomes, which are then rationalised as equilibrium phenomena. And, of course, in such an interpretation, path-dependent organizational capabilities and mental models, as well as fuzzy intraorganizational politics, slid into the background, while the structure of incentives comes in the forefront.

Of course, both levels of analysis are important. But what are the first-order and what are the second-order levels of interpretation?

In the capability (plus politics) story, incentives are there but are second order, and vice versa, in the rational organizational design story. In fact, here rests possibly the most important divide in the analysis of organizational structures and boundaries. It is a divide already present among the interpretations of the *Rates and Directions of Innovative Activities* fifty years ago, and has been present ever since.

In my view the incentive-based equilibrium rationalization tastes far too much of Dr. Pangloss—remember Voltaire's booklet—who was going around between wars, calamities, and earthquakes, proclaiming that all that if it happened, it had to be optimal, since it had to be in the plans of the Divine Providence.

The good news is that the whole analysis of the Bresnahan, Greenstein, and Henderson work holds without putting such a rationalization on the top of it. On the contrary, I would like to enlist it as a major contribution to the analysis of the winding coevolutionary dynamics linking organizational capabilities, strategic visions, modes of intraorganizational governances, and the changing vertical and horizontal boundaries of the firms.

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