

Division of labor, organizational coordination and market mechanisms in collective problem-solving

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Received 16 March 2003; accepted 10 March 2004

Available online 25 August 2005

Abstract

This paper builds upon a view of economic organizations as problem-solving arrangements and presents a simple model of adaptive problem-solving driven by trial-and-error learning and collective selection. Institutional structures and, in particular, their degree of decentralization, determine which solutions are tried out and undergo selection. It is shown that if the design problem at hand is “complex” (in terms of interdependencies between the elements of the system), then a decentralized institutional structure is unlikely ever to generate optimal solutions and, therefore, no selection process can ever select them. We also show that nearly-decomposable structures have, in general, a selective advantage in terms of speed in reaching (good) locally optimal solutions.

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JEL classification: C63; D21; D23; L22; O30

Keywords: Theory of the firm; Vertical and horizontal integration; Computational complexity

1. Introduction

One way to describe any economy or, for that matter, any economic organization, is as a huge ensemble of partially interrelated tasks and processes that, combined in certain ways,

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produce “well-constructed” goods and services. It is a perspective that dates at least back to Adam Smith who identified a major driver of productivity growth in the progressive division of tasks themselves and the associated specialization among workers. More recently, several of Herbert Simon’s seminal works have explored the general structure of problem-solving activities of which technological search and economic production activities are just subsets (Simon, 1969). From different angles, several investigations from the team theory perspective have addressed the symmetric problem concerning coordination amongst multiple interrelated tasks (Marschak and Radner, 1972; Radner, 2000; Becker and Murphy, 1992). Finally, a flourishing literature has focussed on the “cognitive” characteristics of organizations (Richardson, 1972; Langlois and Robertson, 1995; Loasby, 1998; Teece et al., 1994; Dosi et al., 2000).

The contribution which follows has its roots in the foregoing perspectives and focuses on the comparative properties of different decomposition schemes (i.e., intuitively, different patterns of division of labor within and across organizations).

Since a good deal of current interpretations of at least the vertical boundaries of economic organizations is grounded on transaction cost considerations, this is also a good place to start. Indeed, as we shall argue in Section 2, the latter do tell part of the story but fail to account for those powerful drivers of intra- and inter-organizational division of labor that concern the nature of problem-solving knowledge, addressed by more “cognitive” approaches to organizational analysis (Section 3). Next, by building on the discussion of some fundamental features of problem-solving (Section 4), a rather novel formalization of the decomposition of problems and tasks is presented in Section 5 (perfect decompositions) and Section 6 (near decompositions). Section 7 discusses some analytical and simulation-based properties of the model regarding the relative efficiency and speed of adaptation of diverse set-ups characterized by different boundaries between organizations and markets. Finally, we draw some conclusions in Section 8.

2. Problem-solving tasks versus transactions

Think of an industry or the whole economy as a sequence of tasks leading from, say, raw materials to final products. How does one “cut” such sequences within single organizations and across them?

As known, transaction costs economics (henceforth, TCE), albeit rather silent on the intra-organizational division of tasks, focuses on the latter issue, the *vertical* boundaries of organizations.

In a nutshell, TCE (Williamson, 1975, 1985; Riordan and Williamson, 1985), and the seminal argument first developed by Coase (1937) starts from a hypothetical “state of nature” (a logical, if not a historical one) in which all coordination of transactions across technological separable units takes place within markets¹ and predicts that whenever the working of the market price mechanism incurs costs that are higher than the corresponding costs of bureaucratic governance, then the latter can prevail on the grounds of higher allocative efficiency.

¹ “... in the beginning there were markets” (Williamson, 1975, p. 20).

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