Pragmatic Collaborations:
Advancing Knowledge While Controlling Opportunism

by

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ABSTRACT

This paper starts from the observation that firms are increasingly engaging in collaborations with their suppliers, even as they are reducing the extent to which they are vertically integrated with those suppliers. This fact seems incompatible with traditional theories of the firm, which argue that integration is necessary to avoid the potential for hold-up created when non-contractible investments are made.

Our view is that pragmatist mechanisms such as benchmarking, simultaneous engineering, and "root cause" error detection and correction make possible "learning by monitoring" -- a relationship in which firms and their collaborators continuously improve their joint products and processes without the need for a clear division of property rights. We argue that pragmatic collaborations based on "learning by monitoring" both advance knowledge and control opportunism and thus align interests between the collaborators.

We provide several examples of such relationships in the automotive industry, both current and historical. Data from recent surveys of automotive suppliers reveal a proliferation of communications and knowledge transfer activities characteristic of the new collaborative arrangements. We also provide new evidence showing that the famous Fisher Body-GM merger of 1926 (the canonical example in discussions of theories of the firm) was motivated more by considerations of promoting learning than of avoiding hold-up.

We then elaborate our comparison of the "standard" and "non-standard" firm, first at the level of ongoing operational activities and then at the level of strategic direction and corporate governance. We argue that the pragmatist mechanisms crucial to the operations of the non-standard firm have "learning by monitoring" analogues that can be applied to strategy-making and governance decisions.

1. On the (Im)Possibility of Collaboration: Two Views of the Firm

It is now widely observed that firms more and more collaborate with their suppliers, even as they reduce vertical integration with them. This observation seems incompatible with the standard theory of the firm, which argues that integration is necessary to avoid the potential for hold-up created when non-contractible investments are made. In this paper, we start with this apparent paradox (documented with examples both current and historical) in order to elaborate a non-standard view of the firm -- a novel organizational form , neither market nor hierarchy, that addresses the problem of opportunism while at the same time advancing learning and innovation. From this juxtaposition of two views of the firm, we draw a set of implications regarding governance in the non-standard firm, as well as the limits of traditional organizational building blocks such as contract and property

The standard theory of the firm – albeit a stylized portrait -- refines and generalizes a picture of economic activity sketched by Adam Smith, realized in the mass-production US economy starting in the late 19th century, and rendered as history by Alfred Chandler, Jr. (1962, 1977) and others. Its central theme is that the firm, and property in general, exist to reduce hazards of collaboration that could not efficiently be overcome in market exchange. The hazards arises typically whenever (potential) partners can use their control over resources indispensable to the joint venture to extort benefits in excess of those provided in the partnership agreement. Or where some can play on the ignorance of others to claim the benefits due for having performed their obligations without actually having done so.

These problems are pervasive because humans are by nature ignorant and guileful, and they use their guile to extract advantage from one another's ignorance. At the limit they exchange information only when bargaining over the distribution of the potential benefits, tainting what they say and the bargains they strike. Ownership of assets (understood as the exclusive right to determine their use unless otherwise contracted), combined with the legal rights linked to asset ownership, provides powerful instruments for limiting the extortion and deception that daunt cooperation.[1] Examining collaboration

[1] See Holmstrom (1997). By 'standard' theories of the firm, we mean to include such works as Williamson (1985); Hart (1995); and Chandler (1977). For an analysis of differences between transaction-cost and property-rights

across firm boundaries is an indispensable method for discovering just what these instruments are, and when and how they work -- and don't work. The key is learning how to understand economic behavior under circumstances when self-interest threatens to trip itself up, and deprive the parties of the gains of co-operation.

The non-standard theory arises from observations of the inherent sociability of human behavior and the development of reciprocity norms between and among individuals and groups. Its empirical inspiration is twofold: 1) the (Japanese-inspired) "lean" firm that successfully challenged the dominance of mass producers in the automobile and other industries starting in the mid-1970s; and 2) the (primarily U.S.-based) high-tech start-ups in computers, semiconductors, software, and biotechnology that in this same period developed and commercialized whole new technologies. Its central theme is the ambiguity and provisional nature of all understanding, from the simplest verbal exchange to the most complex co-development project. As a consequence, interlocutors and partners must cooperate in pursuit of mutual intelligibility as a condition for self-understanding. In this view, because of the mutual vulnerability resulting from their ignorance of the world, humans are by nature at least as disposed to be cooperative in order to learn as to be guileful. Once the cooperative exploration of ambiguity begins, the returns to the partners from further joint discoveries are so great that it pays to keep cooperating.

Modern corporations, of many stripes and drawing on multiple sources of inspiration, formalize and develop this potential for learning through cooperation. They introduce what we call "pragmatic mechanisms" -- disciplines that reveal the ambiguities of current product designs, production processes, and organizational boundaries. At the same time, they orchestrate joint inquiry -- among collaborating individuals, groups, and organizations -- of these ambiguities. In the process of inquiry, each collaborator can continuously monitor the performance of the (relevant) others, while learning from them

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theories, see Whinston, (1997). For a discussion of other incentive mechanisms besides ownership, see Baker et al, (1998); and Holmstrom and Roberts (1998).

and acquiring skills that can be redeployed in other joint ventures. The overall result, which we will call learning by monitoring, becomes the basis for pragmatic collaborations.[2]

From the perspective of the non-standard view, the significance of these pragmatic mechanisms is that they relax constraints of endemic ignorance -- the systematic incapacity to learn enough to be invulnerable in exchange -- that the standard view regards as constitutive of human nature. Firms exist in this non-standard world because it is necessary to fix the points of view, expectations, and responsibilities of the collaborators in order to evaluate and revise them through collaboration.[3] The exploratory results from any one collaboration become the basis for adjustments as necessary to facilitate the next joint activity. Put differently, the *de facto* joint residual control over assets deployed in the common project becomes the basis for deliberation over the shape of the next project, rather than a source of unproductive haggling.

The non-standard firm uses a number of pragmatic mechanisms (described below) to create and maintain the conditions under which two or more firms can sustain collaboration. These mechanisms help overcome both the problems of bounded rationality and of opportunism

In the rest of this paper, we argue that collaborative development is now (and has been for crucial historical periods) much more central to the activity and organization of U.S. firms, particularly in the automobile industry, than the standard view allows. We then deepen and extend the non-standard view to account for the institutionalization of ongoing incremental (and cumulatively radical) innovation among collaborators. Our project is both positive (we show evidence that firms have in many cases adopted these practices) and normative (we argue that more firms *should* adopt these practices.)

The argument is organized in four additional sections. The second section presents three examples of collaborative supplier relations, all drawn from the automotive industry: a) Japanese

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[2] For related views in current organizational literature, see Schon, 1973, Weick, 1995. The roots of the pragmatist perspective, as we use it here, lie in philosophical writings by von Humbolt, Hegel and Dewey, and in the anthropology of Mauss and the early Bourdieu. See, for example, Bourdieu, 1977. Also, see Sabel (1995) for an earlier exposition of "learning by monitoring."

[3] For more on the firm as a source of identity that guides the coordinated action of its members, see Kogut and Zander (1996).

keiretsu from the post-war period to the early 1990s; b) current subcontracting trends in the U.S.; and c) a reinterpretation of the purchase of Fisher Body by General Motors in 1926, often cited as the paradigmatic example of the emergence of the modern, vertically-integrated firm.

The automotive industry is a logical choice for multiple reasons. First, we can draw upon our extensive past field work in the industry for a detailed account of collaborative processes and pragmatic mechanisms[4]. Second, the make-or-buy decision in this industry has been the *locus classicus* of empirical and theoretical work on the nature and boundaries of the firm since Coase. Third, it is powerful to find evidence of collaboration in the setting where vertical integration is understood as the archetypal response to the hazards of collaboration.

The third section presents a systematic explanation of such collaborative innovation by sharpening the contrast between the two types of firms -- standard and non-standard. We emphasize how, for each type, the division of labor and governance structure are linked to a particular notion of cognitive possibilities, i.e. a distinct view of the relationship between the context of our problems and the activities we should undertake to solve them. Put differently, we contrast a familiar class of (standard) firm that resigns itself to operate within routines as a condition for efficient action, and an unfamiliar (non-standard) one that achieves efficiency precisely by systematically questioning routines without vitiating them as guides to action.

This section also explores in more detail the advantages of pragmatic collaborations. We consider both the efficiency and effectiveness of these collaborative arrangements, particularly with respect to the production of useful knowledge, but we also describe how the arrangements control opportunism by aligning the interests of the collaborators.

In the fourth section, we look at issues of dynamics—how pragmatic collaboration gets started, and what can undermine it. We argue that the claim that the non-standard firm can thrive only under certain institutional conditions (e.g., manufacturing in Japan) has been undermined by the successful

[4] This paper draws on (but for space reasons does not repeat) extensive field work by the authors in the auto industry. See for example, MacDuffie (1997); MacDuffie and Helper (1999); and Sabel (1995).

diffusion of the non-standard approach to a wide variety of contexts. We conclude that the process of disciplined joint inquiry, using the pragmatist mechanisms, can actually generate the conditions necessary to maintain and nourish a collaboration, even where the institutional environment appears highly prone to concerns about "holdup."

In the same section, we address open questions in the non-standard view regarding the boundary of the firm, and its determination of strategy. Notwithstanding the experimental character of the new collaborations, there are emergent answers to these questions. We find that the problem of strategic choice is made subject to the same disciplined scrutiny of assumptions that is brought to bear on the choice of products, production processes, and organization design. The non-standard firm develops a series of institutional devices -- ranging from novel metrics connecting the performance of operating units and corporate wholes to new ways of linking managerial career paths and corporate reorganization -- to support the definition and investigation of strategic choices though collaborative problem solving. Thus strategy, and boundaries, can be seen as joint products of the operation of the non-standard firm.

The fifth section provides a summary and conclusion. We note that in this paper, we take the "standard" view of the firm from economic theory as a starting point. We identify challenges to that view from observations of current business developments and reinterpretations of business history, and advance a "non-standard" view of the firm as a better way to explain those observations. In addressing a central question about bilateral collaboration between firms -- e.g. why don't concerns about "hold-up" prevent collaboration? -- we choose not to address another set of questions, drawn from economic sociology, about the role of networks of firms in the production of knowledge and the generation of rents.[5] In the concluding paragraphs of the paper, we suggest how our future work could address these latter questions.

2. A Profusion of Surprising Collaborations: Repainting the Picture of the Firm

[5] See, for example, Dyer and Singh (1998); Gulati (1998); Kogut (1998); and Powell (1996).

In this section, we draw on three pieces of evidence of collaboration from the automotive industry worldwide. The first, Japanese subcontracting in the postwar period, was the focus of considerable scholarly attention during the 1980s. Collaboration between large firms and their subcontractors was widely seen as a key source of Japanese competitive strength, yet was often viewed as culturally and historically idiosyncratic. Yet the same pragmatic mechanisms now found in very different cultural settings are readily apparent in this Japanese example. Second, we draw on primary data from the U.S. and Canada, collected by Helper in 1993, showing that car manufacturers today collaborate more closely with suppliers than they did 20 years ago. Yet the suppliers not only remain independent but also are able to reduce their own vulnerability to customers by diversification. These new relationships represent, in our view, a hybrid form of organization, one where the ability to participate in learning is at least as important a criterion for partner selection as low bids on piece price.

Third, we examine the takeover of the Fisher Body company by General Motors in 1926, arguing that the takeover was unlikely to have been motivated by standard concerns for the alignment of the interests of principals and agents because General Motors substantially controlled Fisher Body before the "takeover." More broadly, we show that the transaction occurred in a period in which the major automobile producers, and Chrysler (the most successful new entrant) in particular, were building relations with suppliers strikingly similar to those observed currently in the U.S. and elsewhere. Fisher Body was a pioneer and master of such collaborative relations. This revisionist view confronts the long-held affection among economists towards Fisher Body as the prototypical example of vertical integration to overcome problems of holdup; for a collection of challenges along similar lines, see a special issue of the *Journal of Law and Economics* (forthcoming).

A. Japanese subcontracting

The literature on the close relationships between Japanese automakers and their suppliers is extensive (see, for example, Dore (1983); Nishiguchi (1994); Sako (1992); Smitka (1991)) and we will only briefly summarize it here.

Close relationships between automakers (particularly Toyota) and their suppliers evolved in the postwar period. These suppliers were typically either financially independent of their customers, or had less than 10% ownership by their customers. These relationships included a number of practices that seem untenable from the point of view of the standard theory, since they left parties vulnerable to opportunistic behavior. These practices included: broad, open-ended contracts; provision by suppliers of detailed cost data to their customers; heavy investment by suppliers in customer-specific assets (such as location and the stationing of engineers at customers' facilities); provision by customers of free technical assistance to suppliers; joint product design efforts in which the contribution of customer and a number of different suppliers (often rivals) was neither separately identified nor protected.

Yet, these relationships not only proved to be stable, they also led to excellent performance. Suppliers contributed substantially to Japanese automakers' higher quality (Cusumano and Takeishi, 1992), lower inventory (Sako and Lieberman, xx) , and more efficient design (faster lead times and fewer total engineering hours) (Clark, 1989).

The Japanese success at collaboration was initially attributed to factors unique to Japan. For example, Williamson (1985) concluded, "The hazards of trading are less severe in Japan than in the United States because of cultural and institutional checks on opportunism" (p. 122). Dore (1987) argued that the cultural factor of "goodwill" made opportunism a "lesser danger" in Japan (p. 173). Candidates for institutional checks included supplier associations, life-time employment for the employees of large firms, and bank monitoring of corporate performance that encouraged long-term collaboration. Economies that could not count on the loyal workforce and patient capital that this culture and set of institutions produced could not build the collaborative institutions that depended on these as foundations. Thus, the prospects seemed slight for the diffusion of the Japanese system outside its territory of origin.

B. US supplier-customer relationships

In the individualistic United States, by contrast, strict institutional safeguards were held to be necessary to support investment in specific assets. For example, Monteverde and Teece (1982) argued that assemblers would need to vertically integrate "when the production process, broadly defined, generates specialized, nonpatentable, know how." (p. 206) The existence of such knowledge creates the possibilities for hold-ups even when the assembler holds title to the specialized equipment -- expensive dies or jigs, for example -- used by the supplier. This hold-up of know-how, they argue further, is most often generated in connection with the development of new parts. Hence the greater the design effort associated with part development, the greater the likelihood that design and production will be accomplished in-house.

Looking at 133 automotive components supplied to Ford and General Motors in 1976, Monteverde and Teece show that "the development effort associated with the design of any given automotive component is...positively related to the likelihood of vertically integrated production of that component" (p.212) .

More current investigations of customer-supplier relations in the automobile industry reveal a different world. We draw on a survey of suppliers, independent and vertically integrated, conducted by Helper in 1993. A questionnaire was sent to the divisional director of sales and marketing of all firms listed in an industry guide to major first-tier suppliers (both domestic and foreign-owned) to manufacturers of cars and light trucks in the United States and Canada.[6] Although the Helper data does not permit replication of the Monteverde and Teece study, it does show that the relation identified in the earlier work no longer exists.

To begin with, vertically-integrated[7] establishments are no more likely to be engaged in design work in general or design work on technically demanding parts than independent firms. 50 percent of the vertically integrated establishments in the Helper sample did 'the majority of engineering hours' on

[6]See Appendix 1 for more on the survey.

[7] We defined those firms who reported 30% or greater ownership by an automaker as vertically integrated.

their product's design on the current model, whereas 40 percent of the independent supplier did. This difference is not statistically significant. On the previous model, the shares were, respectively, 35 and 22 percent. Thus vertical integration is today neither necessary nor sufficient for participation in design, and design participation has been growing faster among independents than vertically integrated units. A similar picture emerges if the focus is narrowed to producers of the most technically demanding parts[8]; 67 per cent of all vertically integrated establishments are in this category as against 48 percent of independents.

We also examine the relation between design capability and integration by looking at the most successful of the co-designers -- what we will call the "super suppliers". These "super suppliers" have the following characteristics: they do "the majority" of engineering for current-model parts; have won more than one award for supplier excellence (the first one is today often the indispensable ticket to participation in the supply chain at all); and have at least two customers.[9]

More generally, the Helper study reveals an extraordinary increase in communications between customers and suppliers, independent of formal status as independent or vertically integrated. The volume of face to face, fax, phone, and e-mail exchanges was huge and increasing. All types of interaction occurred, on average, between a daily and weekly basis.

Contacts for the purpose of "joint efforts to improve the product or process" were strikingly frequent. Ford suppliers had such contacts with their customer once a day for these purposes, while suppliers to the other firms had such contacts every two days or so.

Another sign of more intimate collaboration is the increasing use of resident engineers. In 1989 only 5 percent of the independent firms and 23 percent of the vertically integrated units reported deploying them; in 1993 the shares had risen to 17 and 38 percent respectively. These engineers spend almost all of their time at the customer's design and/or manufacturing facilities, working to resolve quality

[8] These were parts that respondents listed as 4 or 5 on a 5-point scale of "technical complexity."

[9] This last constraint is surprisingly unbinding; it rules out none of the vertically integrated suppliers, and less than 1% of the independents. While there is no direct evidence in the Helper data that firms with more customers are more profitable than others, a careful investigation of Japanese auto suppliers did show that these firms earn higher returns. See Nobeoka (1995).

problems or to improve designs. While these engineers' salaries are paid by the suppliers, the allocation of their time is largely under control of the customer.

Collaboration appears to be especially marked among the group of diversified, award winning designers -- the super suppliers. We will see below that firms in this group expect to get help from the customer in case a competitor develops a better or cheaper product during the life of the contract. They learn more from their customers than those who are less successful (and who presumably would have more to learn). And they do this without reliance on vertical integration or elaborate contracts. Note also how different these relationships are from the economists' model of perfect competition, since a customer is not free to switch instantaneously among many sellers without losing a partner it has learned how to learn from.

The success of Japanese firms in the US, and the adoption of many "Japanese" practices here, makes it difficult to argue that vertical integration or detailed contracts are necessary to support collaboration between firms. Now we want to show that collaboration is not even novel in the US auto industry. Despite the emphasis in the standard view of the historical importance of the threat of opportunism in the rise of the modern firm, recent writing portrays broad segments of the US automobile industry as having anticipated key elements of the current customer-supplier relations in the first decades of this century. Thus, it is also hard to argue that technological factors (such as the diffusion of computers) drive the development of these organizational forms.

C: Retelling the History of Vertical Integration in the US Automobile Industry

The takeover by General Motors of the Fisher Body Corporation in 1926 has become the canonical example of the logic of the standard argument[10]. In the version provided by Klein, Crawford, and Alchian (1978), Fisher refused to build its stamping plants next to GM assembly plants, because it feared that dedicated plants would have difficulty serving Fisher's non-GM customers. Fisher also

[10] See for example, Hart (1995), which draws extensively on Klein, et al's account in describing a 'property-rights' theory of the firm. For other recent articles which cast doubt on Klein, et. al's interpretation, see the special issue of and Brooks and Helper (2000).

refused to change a cost-plus pricing agreement in its original 1919 contract, an arrangement that proved unexpectedly lucrative due to unforeseen increases in demand for the closed steel bodies made by Fisher. In this view, the purpose of GM's purchase was to resolve an agency problem arising from asset specificity. GM put a high enough value on the advantages of dedicated resources that it was willing to buy control of Fisher from its owners. Indeed the whole point of the story is that control is all that mattered: each side was presumed to know the capacities and intentions of the other, and the only question, decided by title of ownership, was to whose purposes resources and wills would be directed.

But this account is incorrect, regarding both the Fisher-GM relationship and the larger context of customer-supplier relations in the industry.[11] Three corrections are particularly important : 1) Questions of residual control played at most a subordinate role in the transaction; 2) Fisher, like many other large suppliers, met GM's needs for dedicated resources without abandoning collaboration with other customers; and 3) in the 1920s and 1930s, US auto firms were more intent on extending and regularizing collaborative relations with suppliers than resolving agency problems through vertical integration. Beyond these corrections, we offer a different interpretation of the history. We argue that the aim of the Fisher Body transaction was to enlist the aid of the Fisher brothers in constructing such a collaborative system within GM. From this perspective, the point of the deal would have been to transfer expertise rather than control -- or, more specifically, to transfer expertise in the collaborative organization of expertise rather than grant exclusive control as a substitute for collaboration.

Our revisionist approach begins by noting discrepancies between the standard account and some facts. First, as Klein, Crawford, and Alchian register in a footnote, GM had owned 60 percent of Fisher since 1919. From 1919-1924, the stock was governed by a trust with two of the trustees representing GM, and two representing Fisher. However, this trust agreement expired in 1924, two years before GM bought 100% of Fisher.[12] GM's majority ownership should have been sufficient to give GM a strong voice in Fisher's decision-making after 1924. Indeed, the pricing agreement was

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[11] We are very grateful to Thomas Marx of General Motors for generously providing us source materials from his own research into Fisher Body.

[12] GM board minutes, September 25, 1919; Chandler and Salisbury (1971).

revised in 1924, to require that Fisher's prices be set in the same manner as at GM's wholly-owned divisions (Chandler and Salisbury, 1971, p.576; Freeland, forthcoming).

Second, Fisher had already begun to co-locate plants with GM facilities under the trust arrangement. A 1924 report for stockholders states:

> Wherever, in the United States and Canada, there is an important passenger car plant of Buick, Cadillac, Chevrolet, Oakland, or Oldsmobile, there is, or will be close by, a plant of Fisher Body, adequate to meet the demand for closed bodies of high quality.[13]

Much of this plan had already been carried out.

> In 1923, GM undertook a major expansion of Chevrolet chassis production facilities and opened Fisher body plants adjacent to each new Chevrolet factory. During that year pairs of Chevrolet chassis plants and Fisher body assembly plants began joint operations in Norwood, Ohio; Janesville, Wisconsin; and Buffalo, New York.[14]

At this time Fisher also had body plants in Flint (near Chevrolet and Buick), Pontiac (near Oakland), and Lansing (near Olds), all in Michigan.[15] This building boom resulted from informal discussions, not from installation of institutional safeguards: The authorized biography of William Knudsen, the architect of Chevrolet, reports that "Early in Knudsen's career with General Motors, he persuaded Fisher to build body plants adjacent to Chevrolet factories." (Beasley, 1947, p. 141. Knudsen had come to GM in 1921, five years before GM bought complete formal control of Fisher.

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[13] "Fisher Body: Its Contribution to the Automotive Industry". General Motors, December 1924, p.8.

[14] See White (1991), p. 56.

[15] For the locations of Fisher's plants and their dates of opening, see the June 1, 1933 summary of the Fisher Body Corporation, division of General Motors, reproduced in Pound (1934). For location of GM plants at the time, see the GM annual report, 1920, p. 12. Why do Klein, Crawford and Alchian report otherwise? They seemed to have relied on Alfred P. Sloan's testimony in US vs. du Pont, GM, et al in 1953 , In this testimony, given almost three decades after the events took place, Sloan does say that "the Fisher Body Corporation was unwilling to put an investment in these [body] assembly plants", but this statement is a) contradicted by the facts above, and b) only a minor part of Sloan's explanation of why GM bought Fisher. He gives more weight to problems with Fisher's cost-plus contract and to the fact that the Fishers "… were very capable people and … we needed that kind of talent at General Motors at the time, and needed it badly, and I was very anxious to have them come in and help us in the broader problems of General Motors." (US District court trial transcript no. 49-C-1071, p. 2908-9).

Third, the advantages of asset specificity in form of co-location were sometimes offset by other considerations, as the major automakers routinely continued to have bodies made by outside companies for decades after GM bought Fisher. Even GM procured some bodies from the Budd Company (Schwartz, 1999, p. 10). Ford obtained bodies from Budd, Murray, Midland Steel, and made some in-house. About two thirds of the outsourced total was provided by Briggs. In 1929, it even signed a renewable 5-year lease to make these bodies in Ford facilities. Output from the rented Ford plant was sold to other manufacturers as well.[16]

A.O. Smith supplied GM, Ford, and other automakers with frames starting in the 1920s, and still provides these customers today. Indeed Ronald Coase, the intellectual forebear of the standard theory, visited an A.O.Smith factory in Milwaukee in the 1930s, drawn by the firm's reputation as one of the most efficient manufacturing companies of its day (Coase, forthcoming). Its evident success as an independent producer caused him to reject in advance the idea that vertical integration was the most efficient solution to problems of interest alignment -- the view that later came to dominate the literature on transaction-cost economics. (We will return to this theme below.) There are many other contemporaneous examples of such dependence of customers upon independent suppliers for key parts.[17]

These examples draw attention to larger changes in industrial organization of the period that transform the context and thence the significance of the standard account. In the revised picture, we present the pre-1940 auto industry as an independent discoverer, *avant la lettre*, of what are now called Japanese methods by US automobile producers.[18] Supplier-customer relations were Japanese-

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[16] ?Body by Briggs?, *Special-Interest Autos*, Nov.-Dec. 1973 pp. 24-9. In 1953, Briggs was bought by Chrysler.

[17] For example, GM bought more than half of its brakes from Bendix (a company in which GM had a 25 percent ownership), and Bendix sold GM more than half its output; after selling its internal supplier of glass, National Plate Glass, to Libbey-Owens-Ford, GM sourced two thirds of its windshields from the new owner. Ford was substantially dependent on outsiders for rubber, aluminum, wheels, brake shoes, assembled bodies, and radiators. See Schwartz (1999), p.13.

[18] This account draws on Schwartz (2000), Hochfelder and Helper, 1996); and Helper (1991).

like in the sense that they involved long-term associations, joint product development, and attempts to minimize inventory while producing a variety of products.[19]

At the turn of the century, suppliers were larger and more established than assemblers; in many cases they had long produced for other industries, such as carriages and bicycles. These suppliers were important sources of both innovation and working capital.[20] Later, ideas and financing flowed both ways. For example, at Ford in the 1909-14 period, "the Company was not then averse to purchasing virtually all of its materials and parts from independent producers" in the 1909-14 period. The automaker shared its growing management expertise with its suppliers.[21]

Joint design was also a feature of this period (although with power relations reversed to a surprising degree). For example, Timken advertised that "Timken axles in your car, no matter what its size or price, were selected and installed only after many conferences between Timken engineers and the engineers of the car builder". Timken admonished these car builders that they could not include Timken axles "merely to furnish a selling point; *they must be built in* -- not tagged on"; Timken often insisted on modifications in the car's design before it would allow the axles to be installed. [22]

Between 1915 and 1925, there was a shift toward vertical integration, as Ford built his own parts plants, and General Motors acquired a number of part makers. Between 1920 and 1925 internal production increased from 45 to 74 percent of new car value. After 1926 there was a return to outsourcing (and no reversal of this general strategy until after World War Two.) By the early 1930's two-thirds of Ford's cost of production came from outside suppliers. At GM the share was lower, but

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[19] Relationships were different from the Japanese model as it first became known in the West in the 1970s and 80s in that the subcontractor was not necessarily the junior partner, and that the system was less self-consciously organized, more "feral" as Schwartz (1999), p.1 describes it.

[20] See Helper, 1991, for details.

[21] "The Ford Motor Company purchased materials for its components-makers, reorganized their manufacturing processes, supervised their larger policies, and, in some cases, aided them in financing production. The Company became so dependent upon the production of its specialized suppliers that its own operations were frequently within thirty minutes of suspension because of tardy deliveries of parts or materials." Seltzer (1928), pp. 89-90; 100. "A Financial History", pp. 89-90; 100.

[22] Advertisements in *The Auto Era*, Feb. 1916 and August 1917, inside back cover. See also Hochfelder and Helper (1996), pp.4-6.

largely because of the acquisition of Fisher Body, which accounted for 25 percent of production costs. Chrysler bought 80 percent of parts (accounting for 40 percent of total value) from outsiders as of 1938 (Schwartz, 2000).

The return to outsourcing was a response by the established producers, especially Ford and GM, to two threats, both linked to the continuing existence of independent parts suppliers. The first was new competitors -- independent firms that assembled standard parts in leased facilities to enter the market cheaply, without the high fixed costs associated with product development and capital investments. The second threat was used cars, repaired and sometimes improved with parts provided directly by suppliers and installed by small firms with low fixed costs. Once the depression started, these threats were joined by an opportunity: automakers found attractive prices from outside suppliers who were desperate to fill their factories.

To counter the threats, established makers increased the pace of innovation. This raised the barriers to entry for independents and reduced the attractiveness of used cars compared to new ones. GM led the way with introduction of the annual model change in the early 1920s with Ford, the holdout among the major producers, finally following suit with the switch to the model A in 1927.

The drive for innovation, however, led to deepening collaboration with the parts suppliers, not, as the standard account might suggest, their marginalization. The costs of development were simply too high for even the richest of the assemblers to bear alone; hence the efforts to reduce these costs by co-developing components of all types with suppliers. The suppliers, in turn, reduced costs by co-developing variants of each product with other major customers and by drawing on experience gained in the aftermarket.

The upshot was the proliferation of collaborative arrangements that strikingly anticipate the non-standard customer suppler relations reflected in the Helper data reported above (Schwartz, 2000; Langlois and Robertson, 1989). "By the mid-1920s," Schwartz writes, "GM had developed and implemented a policy much like that of Toyota: seeking out more than one source for all its components, limiting the number of sources to two or three companies, and establishing long-term relationships with

these firms" (pp. 72-3). The corporation's relations with Libbey-Owens-Ford for glass products, and with auto-body makers such as Budd (despite the amalgamation of Fisher) were instances of this policy.

Similarly, Hounshell (1984) notes that "Ford went to outside suppliers more and more during the early years of the Depression" (p. 300). The resulting collaboration was crucial to the success of such large design changes as the changeover to the V-8, as well as the solution of the thorny problems of machine design and production layout typically accompanying introduction of new components.[23] Accounts of Ford operations from the mid-1930s portray such co-development as crucial to the firm's operating routines.[24]

The same drive to innovation that led to reliance on outside suppliers also led to creation of a "hand-to-mouth" inventory system, a precursor of just-in-time in which almost no stocks of parts were held in reserve against supply disruptions.[25] The switch to hand-to-mouth inventory in turn reinforced the reliance on inventive collaboration with outsiders.[26] The connection between innovation and the need for inventory reduction was straightforward: lower levels of inventory reduced the costs of working capital and raised the share of total funds that could be directed to meet rapidly increasing development costs.

The embodiment of these developments was Chrysler Corporation. Its founder was Walter Chrysler, who made his name while rising to be president of Buick-GM, only to quit after falling out with William Durant, the initial architect of General Motors. Prototypes of the first Chrysler model were co-developed by a team of three in-house engineers working with component suppliers mostly in Detroit but as far away as Ohio and Indiana. Every component of that first model was outsourced; assembly

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[23] Hounshell recounts the co-development of new gas tank for the model A by Ford and The Gibb Company. Henry Ford developed a radical new design. But existing equipment could not seal the tank at production volumes. Gibb, which manufactured welding equipment, sent technicians to the plant. Together with Ford engineers and production workers they redesigned the tank, welder, and the assembly process concurrently. Hounshell 1984, pp. 284-85.

[24] Barcaly, cited in Schwartz (20001999), p.74

[25] Inventory turns at the Ford River Rouge plant were in the range of 35 to 40 per year in the early 1920s - comparable to the levels achieved by the best Japanese producers 60 years later. Schwartz (2000).

[26] However, the "hand-to-mouth" system did not include JIT's link between ever-tighter inventories and quality control.

was in a rented facility. The finished product included many features previously available only on luxury models that cost three times as much as the Chrysler, suggesting that the co-development efforts achieved remarkable gains.

Chrysler's second major model innovation, the Plymouth, carried the logic of collaboration a step closer to the modern system traced above. Again the design was co-developed with suppliers. But for the Plymouth, the product plan called for ongoing and substantial improvements in the efficiency of the production process after the model was introduced. The Plymouth entered the market in 1929 in the low-to-mid-price range. In the following three years, joint efforts by suppliers and assembler reduced production costs by 30 percent, and the well-equipped Plymouth began to compete with entry-level Ford and Chevrolet models. Here the innovative capacities of collaborative supply relations were made manifest to a whole industry.

To complete the reinterpretation of the Fisher Body transaction, we note that Fisher Body was an industry leader in collaborative supply arrangements. During WWI, Fisher and Hudson had co-developed the first cost-effective closed auto body. This development attracted the attention of General Motors and led to its initial acquisition of 60 percent of Fisher stock. But the Fisher-Hudson collaboration continued despite the change in formal ownership, and with the additional help of machine-tool makers the two firms developed techniques for stamping large body panels from wide sheets of steel. This so reduced welding and other manufacturing costs that a sedan could be produced for the price of an open-bodied car (Schwartz, 2000, p.72). In 1923 Fisher Body collaborated with the Chrysler design team to produce the curved fenders and bumpers that would eventually come to be associated with the idea of streamlining.[27]

From here it is a short step to turn the standard view topsy-turvy. Fisher Body was superb at developmental collaboration; it could provide dedicated resources if GM needed them; and GM was showing no sign of caring deeply about asset specificity (as demonstrated by its increasing use of

[27] Schwartz (2000, p.71. Fisher also collaborated with competitors; Charles Fisher and Walt Briggs were "fast friends" who would spend "many an evening together" and "talk shop, compare notes, and even help each other on sticky business decisions." Charles Fisher served for a long time on Briggs's board of directors. ("Body by Briggs", p. 24).

outsiders in crucial supply relations). So is it not possible that GM bought the outstanding shares of Fisher Body in order to acquire the expertise of the Fisher brothers in organizing, its – GM's -- operations, rather than to impose its will on their company?

There is a surprising amount of evidence in favor of this view. First, contemporary accounts support it. For example, Pierre Dupont, in a letter to a board member describing negotiations with the Fishers, states that in return for stock, in 1924 two of the brothers had:

> … agreed to sever their connection with the Fisher Body corporation and become members of the General Motors executive committee, for the purpose of acquainting themselves thoroughly with General Motors operations and difficulties, without any allotment of specific duties. This I think is a step forward. As it has not been possible for Alfred Sloan to give personal attention to all of the ramifications of the Corporation, I think the Messrs. Fisher are especially well adapted to assist him in ferreting out troubles promptly and applying remedies.[28]

Similarly, the GM annual report for 1926 asserts:

> Many benefits will accrue through the consolidation of the two properties. Of even greater importance [than operating economies], is the bringing into the General Motors operating organization in closer relationship, the Fisher brothers, through whose constructive ability, foresight, and energy the institution bearing their name has been built up to the dominating position it now holds. (p. 10).

The brothers were famous as team players,[29] with expertise in just the mix of design, production,[30] and management skills that were succeeding at Chrysler. Thus their accession to GM

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[28] Letter to Sir Harry McGowan, 10/21/24, Defendants' trial exhibit, Fisher Body Corporation, 366 US 316 , 5/22/61. See also the quote from Sloan above.

[29] The Fishers "were team players both at GM and in their family business ventures, and their practice of discussing business matters each day at luncheons and making decisions as a family was among their most famous characteristics. The Fishers collaborated so closely, a GM vice president once joked, that when one of the brothers cut himself while shaving, they all bled." See White (1991), p. 61.

[30] In particular they had engineering talent which allowed them to see how to develop machinery which would produce at high volume pieces durable and precise enough to withstand the speed of a car. "Fisher Body: Its Contribution," p. 4.

might well have looked to contemporaries more like an effort to reorganize the latter than an assertion of the power of a principal over its agent.

This interpretation accords with that of Chandler and Salisbury, who write that the desire to gain access to the Fishers' management skills was the motive for GM's increase of its ownership of Fisher Body from 60 to 100 percent. They do not mention asset specificity as a consideration.[31] Finally, the Fisher brothers were paid in stock, and this form of payment is compatible with the intention of drawing them into the active management of the corporation.[32]

What was it that the Fishers did that made them so valuable? They had considerable design and engineering expertise, as mentioned above. But most important for our story, they helped GM adopt inside the corporation the collaborative style that Chrysler was using with outside suppliers. [33] Put differently, the Fishers contributed greatly to the multidivisional corporate structure and system of coordinating committees that Alfred Sloan so masterfully developed to manage GM. To repeat, this analysis stands the standard account on its head. Instead of seeing the "takeover" as a response to the threat of opportunism, it presents the amalgamation as an effort to construct a variant, suited to the conditions of GM, of a collaborative supplier system most clearly articulated in the 1920s by Chrysler.

Buying Fisher Body was only one way for GM to achieve this goal; legal counsel could probably have devised instruments that accomplished the same ends without a change in ownership. Our point is that in designing their firm's organizational structure, managers consider effects of that structure on learning as least as much as they do effects on opportunism. In the Fisher case, there is no evidence in the extensive records available that the brothers behaved opportunistically in the sense of

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[31] Chandler and Salisbury, 1971. See also Beasley (1947, p. 141), who says that "[Fred J.] Fisher's was a compelling voice" within GM in the early 1920s.

[32] From this perspective the fusion with Fisher anticipates the fusion of GM with EDS in the 1980s. In both cases, on this interpretation, the corporation amalgamates a major supplier in order to learn how to organize its own affairs. On the relation between GM and EDS see Levin, 1989.

[33] For example, at Cadillac (before (and especially after) the merger, Lawrence Fisher worked closely with supervisors and paint-supply company personnel to improve the paint process, relying heavily on practices formalized later as Total Quality Management, such as organized experimentation and employee involvement. One outcome was to reduce drying time for bodies from 21 to 7 days. (Lawrence Fisher testimony, *US. v. Dupont* 353 US 586 (1952), fol. 998-1025.

"self-interest-seeking with guile" (Williamson's 1975 definition). They did not withhold information or seek to mislead GM. They did, however, want to maximize their incomes. Aware of this, GM changed the financial incentives offered to the Fishers in order to get their full attention. This is a very different account from the opportunism story: instead of buying Fisher Body because they did not trust the Fisher Brothers, GM bought Fisher Body because they trusted the Fisher Brothers so much that they wanted them intimately involved in managing all of GM's assets.[34]

To review the argument so far, we find that current customer-supplier relations in both the Japanese and the US auto industries are not like those depicted in the standard account. We further find that the paradigmatic case of the standard logic has surprising affinities with non-standard developments today. We turn now to a more systematic comparison of old and new forms of organization and assumptions about the possibilities and mechanisms of cooperation that underpin them.

3. Two Ideas of the Corporation

In this section, we return to the contrast between two ideas of the corporation, primarily to elaborate our portrait of the non-standard firm. We approach this task from multiple perspectives. First, we present an ideal-typical sketch of the standard firm as treated in the economics and industrial organization literature, in order to highlight differences from the non-standard firm that are our primary focus here. This sketch is not entirely conceptual; as we note below, the standard view gained widespread acceptance because it captured with notable fidelity key empirical features of the postwar era of large corporations operating under relatively stable economic conditions. Still, we do not pretend to give the standard view equal time here, for its parameters and tendencies are already well-documented. Second, we offer a description of the pragmatic mechanisms that characterize both the internal operations and the collaborative activities of the non-standard firm, drawing in part on the empirical examples highlighted in the previous section and in part on our field-based investigations of

[34] See Coase (forthcoming); Brooks and Helper (2000).

such firms. Third, we address our central performance claim, that the non-standard firm is, in collaboration, able both to advance knowledge and control opportunism,

A. The Standard Firm

At the origin and core of the standard view are industrial organizations with distinct characteristics: centralized, hierarchical, and vertically integrated. Goals set by headquarters were realized by hierarchically ranked, specialized sub-units, all part of a single organization. For much of this century, these features were seen as expressing basic and incontrovertible principles of effective human action.

Guiding Principles. The first principle is that the division of labor is efficient. Adam Smith gave powerful reasons for thinking that coordinated effort by one top-of-the-widget maker and one bottom-of-the-widget maker can produce more per unit of time and other resources than two whole-widget makers working separately. The greater the subdivision of labor, the greater the efficiency; furthermore, the greater the extent of the market, the less the risks of dedicating resources (in the form, say, of single-purpose, automatic machines) to the highly specialized tasks of finely divided labor.

Given extensive markets, Smith's ideas culminate in the familiar notion of economies of scale: the greater the production volume, the lower the unit cost. Separation of conception and execution, and the centralization of the former at the top of a corporate hierarchy follow immediately. The precondition of efficiency in this case is a superintendent with comprehensive knowledge of market possibilities and production techniques to design the product and initiate subdivision of production into specialized tasks, each of which can be further decomposed by subordinates.

The second principle, in many ways a corollary to the first, is that this efficient specialization creates vulnerabilities. The more highly subdivided the production of any product, the tighter the connections or the more complementary the relations among the single components of the production process. Conversely, the less likely it is that any of those components can be put to use in other

production processes. (Consider, again, the example of an automatic machine performing one operation on a single part of a particular model of a given product.)

Owners of highly specialized, complementary resources cooperate, therefore, at great risk. Whoever invests first in the joint project can be "held up" by a partner who simply refuses to commit the complementary resources -- without which the initial investment is worthless --except under terms more favorable than originally agreed. But the threat of expropriation deters the initial investor, so the joint project is paralyzed by the prospect of the vulnerabilities it creates. Vertical integration is the organizational answer to this danger of opportunism. If a single owner has exclusive control over all the phases of production -- and has so specialized the division of labor for each phase that there are very few buyers of the relevant goods and services -- the possibility of the owner being held up disappears.[35]

The third principle is an ingredient in the first two. It ties the most basic features of organizations to the limits of human cognition. It acknowledges our manifest inability to perform, in anything like the time available, the calculations necessary to assess the costs and benefits of the choices plausibly open to us at any moment. To act, given this bounded rationality, we must economize on our limited attentiveness by making use of the expedients of habit and the subdivision of complex tasks into simpler ones. By habit, we take crucial elements of our situation so for granted that we don't need to be attentive to what we are assuming and how it shapes our further thoughts. We break problems down into chunks whose separate solutions are within our cognitive grasp, and which can then be fitted together into a comprehensive solution to the original question. When problems are sufficiently complex as to require collaborative solutions, centralization and hierarchy are called upon to partition problems into manageable chunks. But they also ensure that subordinates, who, by definition, know things their superiors cannot, cannot make self-interested use of their expertise.

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[35] On the increases in bargaining power resulting from limiting other agents' alternatives, see Baker, Gibbons, and Murphy (1998), and Marglin (1974).

Routines -- the organizational equivalent of habits -- likewise do double duty. They establish connections among the parts and simultaneously place limits on the operation of each part as necessary to maintain the integrity of the whole. Thereby they limit the possibilities for self-dealing that specialization affords.

The cognitive gains from hierarchical specialization and routinization, moreover, are mutually reinforcing. The more routinized a task, the easier it is to learn. This, as Smith observed in his "pin factory" example, explains the almost superhuman dexterity of operators performing simple, repetitive jobs. But the more routinized the operations -- the more, say, it consists of a few repetitive movements of the hand -- the easier it is to decompose it yet further. Smith counted this possibility of further simplification as another source of the efficiency gains of the division of labor.[36]

The principles associated with the standard firm derive their power, in large part, from the undeniable efficiency gains associated with specialization. Yet these very principles carry with them a caveat about inevitable constraints -- they suggest that organizations, no less than persons, are condemned to knowledge traps of their own making. To know we must specialize; yet in specializing we come to be defined by what we unknowingly take for granted. Hence the true price for organizations of gains through specialization (beyond the risk that a shift in demand will devalue dedicated equipment) is a kind of institutional self-oblivion. To pursue its ends effectively, the organization must stop inquiring why those ends are <u>its</u> ends or why it pursues them as it does. When routines become entrenched as the inevitabilities of common sense, the organization is the prisoner of its history, choosing within the forgotten limits imposed by its initial choices.

Partial antidotes exist. The struggle to survive given scarce resources selects the organizations with routines most suited to the demands of their environments. Even if particular organizations cannot reorient their activities to accommodate change, some organizations will do very well indeed, if their

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[36] Smith suggested this ongoing simplification might be accomplished either by attentive workers or "philosophers" specializing in this very task. In practice, the standard approach leads most naturally to engineers in the simplifying role, given how well the fine-grained breakdown of a task facilitates the process of fully automating it -- and how well automation provides both standardization of routines and hierarchical control.

routines and specialized expertise are well suited to the demands of the environments. Furthermore, in anticipation of their own congenital rigidity, organizations can establish counter-institutions. For example, internal research and development laboratories are established to renew crucial aspects of current routines by routinizing the creation of knowledge. But the very fact that the process of renewing routines must be placed outside the operational core acknowledges that this defect of organizations cannot be corrected from within. Such counter-institutions, by the very existence, thus ratify the view that the astonishing accomplishments of hierarchically specialized institutions are necessarily associated with the danger of stultification.[37]

For the years of the post- World War Two expansion, these potential cognitive and economic costs were so vastly outweighed by the benefits of specialization that these latter alone came to be taken for granted as defining the logic of efficiency. But starting in the mid 1970s, for reasons we will not consider here, the stable markets for standard goods on which this system of production had rested became fragmented and volatile, and some of the costs of specialization were suddenly manifest and onerous (Piore and Sabel, 1984). In volatile and fragmented markets, the prospect of amortizing a huge initial investment in the design of highly complex products and production systems required to achieve economies of scale was dauntingly risky. Firms that responded to foreign competition with bold projects could easily miss their market's window of opportunity and be left with nothing but write-offs to show for their temerity. Firms that responded cautiously saw advances in products and processes passing them by, making obsolete once-vital capabilities.

For a time this Hobson's choice seemed a cruel fact of organizational nature. U.S. companies forgot the collaborative possibilities contained in their own past, and tried merely to cut costs without changing their centralized ways. But in the last decade, under continuing competitive pressure, U.S.

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[37] Indeed, the common opposition of firm and market typically assumes that the market overcomes cognitive stultification in the firm by introducing a variety of relationships and perspectives (Kogut, 1998). Yet arms-length market relationships rarely provide fertile ground for the pooling of perspectives (or, put differently, for the process of making tacit knowledge explicit and shareable) that we identify as critical to pragmatic collaborations. Exposure to such market relationships may destroy the blinders that firms inevitably acquire but it won't necessarily lead to learning and insight.

firms have increasingly come to understand, adopt, and further develop an alternative to mass production. At the heart of this approach is a reinvention of crucial aspects of customer-supplier relations, aspects that formalize ways of interacting that were emergent in the years before World War One and from the mid 1920s to World War Two. Efficiency is still attained, but now quality, speed, and the ability to manage product variety are achieved as well.. And the forgetful rigidity of the standard approach is no longer the price paid for efficiency.

B. The Non-Standard Firm

The non-standard firm is federated, not centralized: decisions of higher-level entities are crucially shaped by the decisions of their constituent units. The federation is open, not vertically integrated: components or services crucial to the final product of one firm can be provided by independent companies, and the firm's internal specialized producers can provide outsiders with crucial inputs. These outward differences are the result of distinctive principles of efficiency and governance; and these in turn are rooted in a new understanding of cognitive possibilities. Inverting the logic of the standard approach, routines become accessible to deliberate evaluation without subverting them as guides to normal activity.

Guiding Principles. Here we elaborate on the pragmatist mechanisms utilized by the "non-standard" firm. The fundamental unit of the new firm is the team or work group. This unit has the responsibility to achieve goals mutually agreed upon with its collaborators, by means that are mutually determined through group deliberation. Thus, unlike the specialized subordinates in the hierarchy of a mass producer, the work group is free to change its internal organization and to choose inputs (tools, engineering services, components, and so on) from either inside or outside the compan(ies) that furnish its members. The choice to "buy" externally rather than "make" internally is not biased by the fact that the relevant product or service is available inside the collaborating firm(s); "inside" resources must

outcompete "outside" resources to be selected. To the extent it has this autonomy, the work group functions as if it were an independent firm, whatever its formal legal status.[38]

Coordination within and across these groups is by novel methods of iterated goal setting -- inspired by organizational breakthroughs in Japan, but no longer limited to Japanese firms. These methods establish a first idea of what to produce (and how) through an exacting survey of current products and processes. This benchmarking -- supplemented by assessments of what new and unproved techniques might become available for use -- disrupts established expectations of what is doable. It thus casts pragmatic doubt on the advisability of current methods and setting the stage for exploration of the possibilities disclosed.

Design follows a disciplined, decentralized process known as simultaneous engineering. Each subunit responsible for a constituent component proposes modifications of the initial plan, while also considering the implication of like proposals from the other subunits for its own activities. Provisional designs are thus evaluated and refined, and the cost of each attribute is compared to its contribution to functionality using the techniques of value analysis/value engineering.

Once production begins, systems of error detection and correction use breakdowns in the new routines to trigger searches for weaknesses of the design or production process that escaped earlier examination. As in pragmatism, the continuous adjustment of means to ends (and vice versa) is both the means and end of collaboration among the producers.

Moreover, the exchanges of information required to engage in benchmarking, simultaneous engineering, and error detection and correction also allow the collaborators to monitor one another's activities, closely enough to detect performance failures and deception before they lead to disastrous consequences. Ultimately, these information exchanges lead the actors to convergent understandings of

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[38] But note that there is great variation across and even within industries with regard to the de facto powers of these groups, and it is rare for teams to have explicit powers to hire and fire, although they often exercise substantial informal control in such matters. The reasons for teams' usually quite limited powers are beyond the scope of this paper. On the temptations of owners to sacrifice learning for monitoring, see Babson (1995).

the world they are exploring. Because it ties mutual assessments of reliability to joint explorations of capability, we speak of the system of collaboration as a whole as learning by monitoring.

Thus, for example, the new-van design team in an automobile firm sets the general performance characteristics of the vehicle by benchmarking the best features of current vans and exploring which innovations under development can be incorporated in its design. It next decomposes these general goals, again by reference to leading examples and comparison of possibilities, into subtasks such as the design of an engine, or heating, ventilation and air conditioning system, and chooses a specialist team from inside or outside the parent company to realize the initial specifications.

The separate project teams elaborate all the subsystems concurrently, applying to that task the same kind of evaluation of competitors' successful efforts and developmental possibilities used in the van team's first round of benchmarking. In addition, they benchmark the production processes central to their eventual products to ensure that the methods employed will meet or surpass the efficiency of their most capable competitors. Engine plants, for instance, will compare their prospective performance, measured in units of output per unit of inputs, with the actual performance of plants making similar engines at similar production volumes and certified, by warranties offered to the final consumer, to be of similar reliability.

This requires companies and units to pool data on the actual performance of key processes; and this they do -- either through bilateral information swapping or often by creating industry institutes that rank each company by process, on condition that each inquiry be accompanied by a full description of the inquirer's own current results. Sharing such proprietary performance data with competitors would have once been unthinkable. But in volatile markets, companies realize it is simply too risky to assume that one's current processes, no matter how much they improve on past practice, are competitive, let alone superior.[39] Then the initial overall goals are modified by the methods of simultaneous engineering, e.g. the engine-design group may find a way to better its target specifications or to cut its manufacturing

[39] Note that bench-marking need not yield just an effort to copy a competitor's product. Creative benchmarkers find ways to use good performance in other industries to challenge themselves. For example, several manufacturers have studied L.L. Bean's order-fulfillment system, and Xerox chose to study Lego for precision plastic molding.

costs if it can persuade other component groups that design characteristics should be modified accordingly.

Refinement of the eventual design continues by means of just-in-time production methods and the error-detection and correction methods associated with it. In just-in-time production, parts are supplied to each work station only as needed: ideally, one at a time. This renders disruptions and defects immediately visible. Breakdowns at one station halt production by disrupting the flow of parts to downstream operations; similarly, defects introduced in one manufacturing step make it difficult or impossible to accomplish the subsequent ones correctly.

To assure the flow of production, therefore, the source of disruption or defect must be identified as a failure of workmanship or an imperfection of design or operating organization. Such inquiries typically require tracing long causal chains back to improbable origins by an insistent series of questions sometimes called the "five why's". For example:

Why is machine A broken?	No preventive maintenance was performed.
Why was the maintenance crew derelict?	It is always repairing machine B.
Why is machine B always broken?	The part it machines always jams.
Why does the jam recur?	The part warps from heat stress.
Why does the part overheat?	A design flaw.

Thus error-detection and correction, like benchmarking and simultaneous engineering, reveals possibilities for improvement in unexpected (mis-) connections among the parts of complex endeavors; and the cumulative effect of these results is captured in improvements in the benchmark standards for various production processes.

The master cognitive innovation of this new type of firm is embodied in precisely these apparently modest, even commonsensical institutions. For benchmarking, simultaneous engineering and error-detection methods like the "five why's" are procedures for doing just what the standard view of

effective action given bounded rationality says cannot be done: routinely questioning the suitability of current routines. Whether in the initial specification of new designs (benchmarking), the concretization of these approximations (simultaneous engineering), or in the course of their practical application (error detection), this disciplined inquiry of routines occurs at just those times when self-interrogation seems most valuable but most difficult.[40]

These mechanisms oblige the actors to search for solutions in a circumscribed space of possibilities (the set of best current or potential designs, the activity chains that might have caused a particular breakdown) whose exact contours and contents they could not have anticipated. The outcome of the search is thus likely to be sufficiently unfamiliar and disconcerting to force re-evaluation of habitual responses. The new firm is thus a member of a new class of institutions defined not by the fixed routines to which they are oblivious, but rather by the routines they use for interrogating and altering their routines. Think of the new institutions as pragmatist: they systematically provoke doubt, in the pragmatist sense of an urgent suspicion that habitual beliefs are poor guides to current problems.[41]

It is group discussion of problems that renders the resulting flood of alternatives tractable. Group discussion meets an immediate objection to problem solving through extensive collaboration rather than hierarchical decomposition of tasks: the geometric explosion of pairwise contacts that such collaborations on standard assumptions entail. If A must consult first with B, then with C, and the latter must then meet by themselves, the sheer number of consultations is unmanageable unless the group is minuscule. If, however, the collaborators meet together (a possibility not contemplated in the standard view of bounded rationality), one meeting substitutes for many, economizing on participants' time.

More importantly, group discussion pools the diverse capacities and experiences of its members to judge the alternatives produced by benchmarking, simultaneous engineering and problem-solving

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[40] It is natural for firms to fall into stable patterns of interaction with their closest collaborators (Gulati, 1998). This may, over time, lead towards the same cognitive stultification that we associated with the internal workings of the firm. Our argument is that the pragmatist mechanisms, through the introduction of doubt about past practices and decisions, serve to prevent such narrowing of perspective, whether within the firm or between close collaborators.

[41] For examples of how NUMMI (the GM-Toyota joint venture) handles the tension between standard operating procedures and continuous improvement, see Adler et al, 1999.

searches. Thus the new-van team convenes specialists in engine and transmission design as well as in styling, marketing, and manufacturing to discuss proposals about the target market in relation to desired engine performance. Each proposal illuminates the others, and all are seen in light of the diversified knowledge of the group; and both the group and its members are enlightened by the interplay of diverse disciplines and projects. The upshot is to reveal possibilities that would remain obscured if those same proposals were scrutinized one by one, or jointly by a lone evaluator.[42]

C. Advantages of Pragmatic Collaborations

We suggested above that the guiding principles associated with the non-standard approach offered collaborating firms the opportunity both to advance knowledge and to control opportunism. Here we address the advantages of pragmatic collaboration explicitly.

Sources of Efficiency and Effectiveness. Despite their manifestly demanding goals, the pragmatist methods described above can be effective even if their initial results are modest. Recall that the aim in benchmarking and simultaneous engineering is simply to reveal sufficiently large differences between current and potential performance to provoke debate about the possibilities of improvement, and, subsequently, about the improvement of methods of improvement themselves. Reaching agreement on the initial characterizations of designs, production methods, and error detection systems should be feasible because these are understood as starting points: provisional and perfectible, not definitive.

Recall, too, that the ensemble of "learning by monitoring" mechanisms does *not* aim to produce an exhaustive, fully replicable characterization of the products or processes to which they are directed. Benchmarking does not produce laboratory protocols by which successful experiments can be reproduced elsewhere. Rather it reveals feasible goals and indicates the feasible set of means for

[42] Placing group discussion at the center of our notion of pragmatic collaboration raises questions about the nature (and possible limits) of firm capabilities for this activity. We believe that the quality of these discussions will be affected by the absorptive capacity of each party (Cohen and Levinthal, 1990) and that repeated interactions may make this capacity partner-specific (Dyer and Singh, 1998). We also acknowledge that there may be a limit to the number (and nature) of different collaborations that a firm can successfully manage at one time, i.e. that a firm's collaborative capacity can be exceeded (Bensaou, 1999; Prahalad, conference discussion).

obtaining them. Error detection systems (which can themselves of course be benchmarked) are then used to determine how to adapt the indicated means to the local setting to achieve the goal. Thus the early characterizations of means and ends provide not just starting points but also a basis for organizing exchanges of experiences among collaborators. The exchanges, in turn, result in learning that allows adjustments after the initial rounds to either design and production process.

This two-fold information pooling -- of plans and perspectives -- yields efficiency gains of a distinctive kind. Where the hierarchical decomposition of tasks leads, as we saw, to economies of scale, information pooling yields economies of scope: the greater the variety of projects undertaken, the less costly it is to undertake yet another variety of those projects.

One source of these gains is suggested directly by the cognitive properties of the new institutions. Comparisons among unfamiliar (in part) alternatives -- competing designs, various possibilities for realizing these, alternative explanations of the origins of defects -- reduces the likelihood of insular, self-absorbed decisions while also reducing the risks of discovering much later the costly shortcomings of particular decisions.

A second source of efficiency gains is the self-reinforcing character of disciplined information pooling itself. Just as the decomposition of tasks facilitates further decomposition, so the methods of collaborative investigation of ambiguity lead, within and among work groups, to increasing dexterity in the use of those methods. There are corresponding increases in the scope of alternatives that can be canvassed and the depth to which their implications can be examined.

The cumulative effect of such efficiency gains allows firms that have mastered these pragmatist disciplines to overturn the verities of the earlier mass-production system, transforming the traded-off desiderata of that world into mutually reinforcing attributes of the new one. For example, it was a truism of mass production that exploration of many design alternatives hindered timely and rigorous pursuit of any one. But the experience of firms in technologically sophisticated industries with extremely short product life cycles shows, on the contrary, that pursuit of many alternatives is the best way of

understanding the advantages and disadvantages of each, and so contributes to selection of the best current possibilities.

Similarly, in mass production a decrease in efficiency was taken to be the price for an increase in quality. Isolated efforts to increase accuracy -- by use, for example, of inspectors at critical operations -- seemed inevitably to interfere with the automaticity of production, reducing the throughput of the system per unit time, and decreasing productivity. Coordinated efforts to increase accuracy (except as the by-product of the increasing decomposition of tasks) seemed unmanageably complex. But the error detection and correction methods of "learning by monitoring" reveal defects in the organization of production that remained hidden under less exigent conditions. Elimination of these defects affords possibilities for raising overall efficiency -- by minimizing downtime due to repairs, introducing delicate automation equipment whose operation depends on maintenance of tight tolerances, reducing the rework of botched products -- that, judging by the relative performance of competing firms using the old and new methods, were simply unavailable in environments more tolerant of fault.[43]

Controlling opportunism. Pragmatist information pooling also provides an alternative solution to the problem of opportunism. That problem arises in mass production, as noted above, as a direct consequence of hierarchical specialization. Resources specific to one project in such a system have only scrap value if put to other use, and expertise is so fragmented and specialized that the doings of one actor or group are inscrutable to others. Hence the temptations of hold-up and deception, to which vertical integration and the corresponding direction by authority and incentive are a response. The new institutions, in contrast, so transform the conditions of cooperation that incitements to trickery can be countered by the very exchanges of information required for the exploration of ambiguity.[44]

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[43] The same automotive assembly plants rank highest on both productivity and quality, according to a global survey by MacDuffie (1995).

[44] Repeated dealings have been cited as a sufficient condition for the build-up of reputations for avoiding opportunistic behavior. (See for example, Axelrod, 1984.) However, in an environment which has been characterized by opportunism in the past, long trading relationships may give the parties more experience with each other's untrustworthiness, and make it more difficult to establish trust. For example, in the auto supplier data cited above, US firms who have more years of selling products to their principal customer have significantly *less* trust in that customer. (Sako and Helper, 1998.) Learning by monitoring offers suppliers a mechanism to collect information on whether or not they should believe their customer's claims that they have changed their ways.

For one thing, the pooling of proposals and perspectives breaks down distinctions between mutually ignorant specialists, each tempted to exploit the ignorance of the other. Where hierarchy produces the information asymmetries of mutual ignorance, learning by monitoring in effect creates an information-symmetricizing machine in which actors must keep one another abreast of their intentions and capacities. In simultaneous engineering and error-correction by the "five whys", for example, actors must teach each other important elements of their respective specialties and reveal the logic of their intentions in order to make themselves comprehensible.

For another thing, the master resource in the new system is the ability to redeploy resources fluidly. As noted above, the novel search routines and problem-solving disciplines help develop this flexibility by breaking apart static procedures. Equally important is the capacity to reuse a high (and increasing) percentage of the capital equipment committed to one project in subsequent ones, by reprogramming the computers that guide its operation or changing one type of tool-bearing module for another. The greater a work team's command of the search routines, the problem-solving disciplines, and the reconfiguring of flexible equipment, the more accomplished it becomes at the redeployment of any resource. The effect is that product-specific resources are "de-specified", coming increasingly to resemble general-purpose assets, and thus no longer the instruments or object of hold ups.

Interest Alignment in the New Collaborations. Next we take a closer look at how "learning by monitoring" and pragmatist mechanisms of information pooling help to align interests between collaborators. If the assets needed for the new forms of collaboration are general purpose and must be acquired in part by collaborating, then firms should be eager, not hesitant, to begin working by the novel methods. Their chief reservation would be fear of engaging an incompetent or unreliable partner; but the information exchanges intrinsic to "learning by monitoring" would alert them to this danger before the consequences were ruinous.

For example, the same process that allows firms and their internal or external suppliers to agree on the definition of a subsystem or its components allows joint evaluation of target prices, target rates or return for collaborating partners -- even a target rate of productivity improvement to be expressed in

periodic price decreases. Simple sharing rules may result, e.g. the supplier keeps at least half the gains from innovations leading to productivity increases in excess of the target rate, with the share falling at a conventional rate as the innovation matures. Persistent performance failures -- such as a supplier's inability to meet price reduction or improvements in product performance in the medium term -- can be penalized by reduction in the supplier's share of the customer's total purchases of the affected product.

At any moment, therefore, collaborators can compare actual performance with expected performance, and analyze any divergences against the backdrop of the extensive common knowledge of possibilities that allowed agreement on the goals in the first place. Suppliers that do exceptionally well in one or more rounds of the product cycle can then be delegated more extensive responsibility in the co-design of subsequent models; those that do exceptionally poorly will eventually be dropped from pool of collaborators.

A complementary mechanism also works to align interests in this setting. Consider the possibility that pragmatic, problem-solving deliberation loosens the hold of interest by fitfully darting, as it were, beyond its reach. Solutions are uncovered bit by bit as the inadequacies of customary answers are traced back towards their source and unfamiliar territory is steadily charted. But self-interest depends as much in its calculations of advantage on settled expectations as bounded rationality depends on routines in its searches. It can no more evaluate the surprising outcomes of pragmatic searches than bounded rationality can anticipate them.

Such uncertainty, even if temporary, about the potential advantages and disadvantages of one collaborative advance can favor pursuit of the next. The value to all parties of the current, partial innovation (measured as improvements in the performance of current problem-solving mechanisms) will likely be increased substantially by the next partial step forward. In addition, the continuous exchange of operating information among the collaborators reduces the risk than any party can use the novel arrangements for self-dealing. The de-specification of assets, continuous monitorability, and simple gainsharing rules -- all offer assurances against the fear of holdup. Thus once provisionally workable

solutions to common problems are at hand, there are incentives to pursue them to increase the mutual advantage, rather than to halt the search to renegotiate the division of gains from the initial advance.

Elaboration of each solution creates in turn new surprises and renews the pursuit of further improvements. In time, as emerging solutions change what the actors do and how they rely on one another, their very ideas of what is possible will come to reflect these entanglements. "Self"-interest will come to take as the starting point for subsequent calculations the collaborative surprises of practical deliberation that it was formerly assumed to undermine. The upshot of all these mechanisms acting together is that the construction of Japanese–type production systems does not presuppose the existence of long-term relations, because the system in the course of its operation produces them.

We can see some of these mechanisms at work by looking at the group of prize-winning "super suppliers" defined above. Firms in this group comprise about 10 percent of the Helper sample. They are clearly engaged in discussion with their customers, with whom they speak by phone on average daily, three times as often as the other suppliers in the sample. More than half of this time is spent providing technical assistance to the *customer* (again a significant difference between the super suppliers and the sample as a whole). But the distribution of benefits from this exchange is not one-sided; these firms are also more likely to report that in dealings with their main customer, they learned much that will help in dealings with the others they supply.

This activity is not supported by clearly-drawn property rights. It is usually impossible to say who owns partly-finished designs, or the rights to determine use of a resident engineer's time. There is no evidence that these dealings are governed by elaborate contracts -- often considered a substitute for vertical integration as a governance mechanism -- that distribute the burdens between the parties in case of a long list of contingencies and provide for arbitration in the case of disagreements. Rather, the response to problems is, as the foregoing suggests, to try to solve them together. The purpose of such formal agreements as there are between the parties is to provide a broad framework of rights and

responsibilities, rather than a detailed attempt to foresee all contingencies.[45] We will see below that in an important sense these agreements should not be considered contracts at all.

Only if the problem-solving mechanisms themselves break down does the relation fail. Fewer than nine percent of the super suppliers expect a customer to abandon them if a competitor offers to provide the customer a product identical to theirs at a lower price. Sixty-two percent of the super suppliers expect, instead, that the customer would help them match the rival's efforts. But such help is not viewed as unconditional: Twenty percent of the super suppliers expect the customer to gradually reduce the supplier's market share if there is no improvement. The message is clear: failure in the short-term will be tolerated if it becomes an occasion for learning that eventually results in improved performance.

Thus the reduction of asset specificity and the improvement of information flow do not mean that adoption of learning by monitoring leads to a replacement of hierarchy by more market-like forms. In the model of perfect competition, actors minimize the prices they pay for commodities with given attributes by switching frequently among many potential sellers. In learning by monitoring by contrast, agents seek to continuously improve products and processes by choosing partners who are good at learning, and by staying with them even if their prices are temporarily higher.

4. Dynamic considerations

Above, we argued against the claim that the non-standard firm can thrive only under certain institutional conditions (e.g., manufacturing in Japan), saying it has been undermined by the successful diffusion of the non-standard approach to a wide variety of contexts. In this section we look at little more closely at these dynamic issues. What causes learning by monitoring to arise, and at times, to fade away? How does use of pragmatic mechanisms change parties' attributes?

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[45] An analogy to individual behavior may be useful. "Some people acquire resources by theft, but mainly they buy them. People do take precautions against being robbed, but it would be a mistake to analyze the system by focusing exclusively on the precautions." (Ronald Coase, personal communication, July 1998).

A. The Rise and Decline of Learning by Monitoring

Even in a short-term oriented, individual-interest-maximizing society like the U.S., learning by monitoring has been spreading, despite the absence of Japanese-style collective institutions. We believe the process of disciplined joint inquiry, can actually generate the conditions necessary to maintain and nourish collaboration, even where the institutional environment appears highly prone to concerns about "holdup." Firms can develop a high-trust equilibrium over time (Aoki, 1984), by starting with projects that have a high payoff and only a small vulnerability. If all goes well, the parties can try larger projects.

For example, Donnelly Corporation, an American manufacturer of mirrors, was an early supplier to Honda's U.S. manufacturing operations. It first started off supplying a relatively standard rear-view mirror, using excess capacity in an existing plant. The pragmatic mechanisms gave both sides a chance to observe each other's trustworthiness. Donnelly saw that the large amounts of technical assistance provided for free by Honda helped lower its costs, and Honda observed Donnelly's willingness to make changes and steady improvements in quality. Gradually, they moved on to bigger projects: first a dedicated plant for Honda, then an entirely new product (side mirrors), and finally a new, complicated process (an automated paint line) and joint design with Honda engineers in Japan. Honda did not make a specific guarantee to Donnelly, but did say that if the supplier performed well at these steadily more difficult tasks, Honda would see to it that Donnelly's business grew (MacDuffie and Helper, 1999).

At the beginning of this process, opportunism may be almost as high as at a 'standard ' firm, but is controlled better through the pragmatic mechanisms. Eventually, managers realize that these mechanisms are sufficiently effective as means of monitoring that if they cheat, they will get caught; so

they desist in attempting to be opportunistic. Because these mechanisms advance knowledge, they increase the payoff to cooperation, as well as reducing that of opportunism, so people get used to cooperating. This strengthens their rule of thumb that cooperation is good. Again they are less drawn to opportunistic strategies. Ultimately, learning by monitoring may create actors who value cooperation as an end in itself. These actors would be betraying their identity if they cheated, regardless of the prospect of detection. Were this to occur, learning by monitoring would have *produced* a culture of trust that would greatly resemble the one once assumed to be its precondition.

Similarly, the degree of asset specificity may evolve over time. Initially, one firm's skills at discussion may be specific to one partner, but may become general over time. For example, Donnelly was so intensively involved in learning the "Honda Way" that its other customers suffered in the first years. But eventually, Donnelly found that the techniques were useful for other customers, and cost and defect levels fell sharply. Furthermore, Donnelly now has many other customers for the painted side mirrors that they had never made before getting the Honda contract.

As Donnelly has extended its side mirror business to other customers, there is some risk to Honda of spillover of the value created in the collaboration. However, the people at Honda most passionately involved with this collaboration seem convinced that, on balance, its benefits outweigh its costs. The most frequently-heard view we heard is, "We all get better this way." The belief that the entire industry benefits from this kind of collaboration can be a powerful motivator for further innovation. This vision of "enlarging the pie" can help to sustain collaborations even in the face of pervasive worries about opportunism or spillover.

But the history of the US auto industry reminds us that if conditions change dramatically, firms may decide it is in their interest to defect from collaborations. As Ford and GM grew, they increasingly suffered from spillovers to other firms, without any corresponding benefit. As they became more powerful in consumer markets, the alternative of pitting suppliers against each other became more attractive, since this strategy protected the automaker's rents from being shared with suppliers, and consumers did not have many alternatives if quality was low. So the automakers abandoned the pragmatic mechanisms for competitive markets in the 1950s, 60s, and 70s. When the Japanese entered the US market, conditions changed again. US automakers no longer had rents to protect from suppliers and found that higher quality was a way to attract consumers. Under these conditions, they rediscovered (primarily through careful study of Japanese automakers) the pragmatic mechanisms (Helper and Levine, 1992).

B. Strategic Use of Pragmatic Mechanisms

A key concern of the literatures on both technical change and managerial strategy is whether being good at one kind of innovation makes a firm bad at other kinds. In particular, it might be that learning by monitoring is a type of incremental change that hinders radical innovation, or prevents dramatic changes in strategy (Abernathy, 1978; Porter, 1980).

Search routines that break through the constraints of habitual responses to design and operational problems may not be well suited to higher-level monitoring. What will happen when these pragmatist mechanisms confront decisions in the province of corporate governance? For example, evaluating the viability of whole lines of business, choosing among very different but plausible long-term development goals, or responding to threats or opportunities facing the corporation as a whole? There

is both empirical and theoretical reason to think that traditional mechanisms of corporate governance—banks with controlling stakes or dispersed shareholders--will not shine at this more encompassing task.

The leading example of the inadequacy of standard governance forms to this task is surely the dismal performance of the large Japanese banks in the last decade (Aoki, 1994, 2000). As contingent corporate monitors, they are supposed to take control of corporations in those contingencies when sitting managers demonstrate incapacity. In practice, during the recessions of the 1990s, these banks have demonstrated scant capacity to act. Firms under their supervision have wasted free cash flow or made major strategic miscalculations about capacity, expansion of product lines, and distribution channels.

The general problem is contained in the following paradox. The information generated by the "learning by monitoring" system for its day-to-day and medium-term needs is also necessary to understand how to correct large errors when they occur. Yet this information is not readily available to the "contingent" monitors -- main banks or shareholders, for that matter -- who intervene in such emergency situations. Only agents monitoring the (non-standard) corporation day-to-day -- which is to say participating in its routine project selection and evaluation procedures -- could know enough of its highly decentralized operations to correct large errors in an effective way. But just such agents are discredited when the errors come to light; and outsiders, whatever bundle of interests they are trying to maximize, simply cannot learn fast enough to be useful. From this perspective, therefore, the differences between "patient capital" banks (with their "voice" view of the corporation as a community) and impatient shareholders (ever-ready for "exit") are less important than the similarities in their limitations.

In principal, at least, the necessary link between daily operations and project selection could be established by a straightforward extension of "learning by monitoring". Recall that simultaneous engineering, benchmarking and error detection all depend on drawing the participants beyond the circle of familiar habits and routines by exposing them to unfamiliar projects and prospects. The diversity of their viewpoints allows evaluation of the novelty, which in turn allows reexamination of their differences. The immediate products of this deliberation are choices among competing solutions to problems and organizational reforms that could prevent a similar occurrence.

Why assume that reflection on possibilities stops here? As competing patterns of problem-solving and solutions to problems emerge, they can be formulated as coherent, if previously unimagined alternatives. In choosing to favor one pattern of problem-solving or a particular solution over another, moreover, a firm is simultaneously making a choice and refining or reinterpreting the criteria by which the choice is made. This kind of choosing and choosing-how-to-choose is familiar from law and other interpretive disciplines, where the decision to apply a precedent changes the subsequent understanding of how the precedent is to be applied. Equivalent choices by a firm define its strategy.

Thus conceived, a firm's strategy would be a joint product of its cumulative problem-solving. Determining the nature or identity of the firm is just the highest level of choice among competing alternatives that is the structuring principle of the new firm. Fundamentally, the firm -- like the products it makes and the way it makes them -- *is* a design problem.

But is a solution to the governance problem on these lines feasible? Recall that the discussion of "learning by monitoring" proceeded from institutional mechanisms -- benchmarking, error detection, just-in-time -- to general principles of pragmatist information-pooling and self-scrutiny. The principles

are credible because they can be embodied in mechanisms that perform what might (absent such demonstrations) be thought impossible tasks: for instance, probing the value of routine assumptions without destroying all routines. Unless we know, for instance, that benchmarking new products is manageable, we might suspect that the exploration of little-known alternatives paralyzes rather than accelerates decision-making. In reaching to the strategic, we raise new questions of feasibility. What are the mechanisms carrying the pragmatist logic to the strategic level? Are there institutional analogs to benchmarking at the level of strategic discussion? If there are, how are they connected to the lower-level mechanisms of institutional self-scrutiny?

There do indeed seem to be such mechanisms, albeit experimental ones. They are much less well characterized than the disciplines discussed earlier, and there is less reason to be confident of their ultimate effectiveness. Consider the following three examples of strategic benchmarking. Together they suggest that firms are intent on addressing the problem of extending learning-by-monitoring institutions to the strategic level, despite being uncertain how (or even whether) it can be done.

The first is Capstone, a "corporate incubator" -- created by the chairman of Ford, Alex Trotman, in 1996 to foster Ford's future leaders by intensifying their focus on strategic possibilities, especially those outside the automobile industry. (General Electric has a similar program, and Toyota has just instituted one.) In the Capstone program four teams of about six managers spend roughly half a year studying critical questions of corporate strategy, proceeding through a series of benchmarking evaluations of alternatives, and concluding with specific recommendations for change. The first such recommendation (at least as reported publicly) was a pilot program, modeled on developments in mass retailing, to consolidate Ford and Lincoln Mercury dealerships into new entities to be jointly owned by

Ford and local dealers. Generalizing the Capstone model, executives at Ford and elsewhere would compete for promotion by proposing (potentially) competing corporate strategies after extensive benchmarking of like choices in their own and other industries, bringing strategic assumptions to the surface while keeping continuing operations close to hand..[46]

A second mechanism, the proliferation of performance metrics, focuses internally rather than externally. The central aim of these metrics is to find measures that reveal the performance of subunits in relation to the performance of the corporate whole. The utility of individual metrics is, however, limited. If performance on a single metric told most of the story of all the subunits' contribution to overall performance, the center could just set good performance on that metric as the corporate goal. In that case there would be little need for substantial decentralization of authority. But if decentralization is warranted (and the assumption in non-standard firms is that it is, because subunit goals diverge and change), then the likelihood of finding truly comprehensive and common indicators of success is limited. (Meyer, 1989)

What individual measures cannot do, baskets of measures can (Kaplan, 1992). Discussion of which measures to add and which to remove from the basket brings to light differences in strategic orientation among the operating units of the decentralized non-standard firm that are then accessible for debate and choice. Thus in a brochure marketing a complex proprietary performance metric called "total shareholder return (TSR)," the Boston Consulting Group stresses that:

> The process of mapping the strategy and resulting value drivers often has as much benefit as the quantitative analyses of alternative actions or strategies. It serves as a catalyst for surfacing

[46] Connelly, M. (1997). Elite Think Tank Devised Ford's Indianapolis Plan. Automotive News**:** 1, 49.

> opinions or assumptions and provides a forum among the operating management team for gaining consensus on action …. [Indeed], a properly designed and implemented value management program ... creates a common language between line and staff, and between corporate and business units. It provides a clear link between strategy and TSR performance.[@]

A third example, combining features of the first two, are U.S. venture capitalists. They operate not only in high-tech industries but, increasingly, in the re-structuring of mature sectors through "leveraged build ups" and other novel devices that allow for profound restructuring of the firm's relation to its customers, use of information, and organization of production. In choosing portfolio firms, and from time to time dropping or adding portfolios, venture capitalists engage extensively in the kind of strategic benchmarking associated with Capstone. In deciding which portfolio firms to abandon and which to continue supporting, they make strategic use of performance metrics. More generally, venture capitalists combine managerial advice and guidance, rooted in something close to day-to-day knowledge of the decentralized, pragmatist firm, with expertise in finance. They are, moreover, too much like managers (or employees or suppliers) to be contingent monitors, whether shareholders or bank monitors.

These examples do not prove that it is institutionally feasible to extend pragmatist principles to questions of strategy and corporate governance. But clearly there do exist actors in the corporate realm who recognize problems in the current connection between the operational and the strategic, i.e. limitations in the standard view of the firm, and are consequently motivated to develop more effective, deliberative alternatives. To the extent they do, they become an important force behind the diffusion of the non-standard firm.

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[47] Boston Consulting Group Brochure, p. 22, pp. 24-25.

5. Conclusion: Some Implications for Economic and Organizatinal Theories of the Firm

The structure of the firm in economic and organizational theory is typically seen as the result of an efficiency calculus. Economic goals and environments are taken as given, and rational agents choose the organizational form that minimizes the costs of attaining the result in the environment. Thus for Coase, firms choose between markets and organizations, preferring the former until the cost of a marginal transaction there exceeds the cost of the same transaction in the latter (Coase, 1988). More recent, but closely related theories portray maximizing agents constructing firms of different configurations from basic building blocks such as contract and ownership. (See for example Hart, 1995; Baker, Gibbons, and Murphy, 1998). Classic theories of organization, especially those focused on the firm, premise similar choices, though often with a richer menu of possible institutional solutions to the problems posed by particular environments. (See for example Barnard, 1947, Selnick, 1949, Gouldner, 1954, and Mintzberg, 1993). In different ways, all of these theories recognize the existence of a turbulent realm beyond the reach of organization. This is the realm of the "informal" (see Barnard, 1947, for whom management of the "informal" to achieve the tasks of the formal organization was in many ways the preeminent function of the executive) or the "adhocracy" (see Mintzberg, 1993) presumed to be of secondary importance to the world of the dominant organizational forms.

Our findings dissolve the distinction between the formal and the informal (or the organized and the unorganizable). We have seen that learning-by-monitoring firms can establish elaborate and robust organizations in environments too volatile for standard forms, but on condition that they make it routine

to question their own routines. These firms are far more structured than informal groups, but their structures are by design much more fluid than those of traditional formal organizations.

At a minimum the existence and rapid diffusion of these firms cast doubt on the sufficiency of the menus of organizational forms and building blocks available in current academic theories. Thus the new forms of collaboration are neither markets nor hierarchies (Powell, 1990). In contrast to a hierarchy, there is no principal among the collaborators who can definitively partition tasks for the others. Moreover, the collaborators' positions within the new arrangements are contestable in way that the places of hierarchical subordinates would not be. In contrast to a market, the collaborators do not merely signal each other through prices. They jointly explore what they want to do even as they are doing it.

This joint exploration, and its implications for subsequent projects, marks this new collaboration off from familiar contractual and ownership relations. In normal contractual relations parties are presumed to undertake distinct tasks, and to be sufficiently knowledgeable about them to deliver certain goods or services under agreed conditions without continuing consultation from the others. In co-development arrangements of the kind discussed above, however, these conditions are not met. On the contrary, what each party wants depends in part on what the others do. Think of an engineer, co-located from a supplier to customer, who suggests how the latter can re-configure a production line to make better use of a part, and suggests to the former how the part might be altered to make optimal use of the new line. We are a long way from arms-length contracting, indeed contracting of any standard kind.

We are far from familiar forms of ownership as well. Ownership, recall, is residual control: the right to dispose of an asset insofar as its disposition is not subject to contract . Put another way, residual control is the owner's right to fill gaps in an existing contract to her liking, or to determine how to re-deploy an asset once contracts controlling its current use have run their course. But now, extending the example just given in the direction of the discussion of project-selection and governance above, suppose that, thanks to the engineer's suggestions, the customer and supplier agree to develop their next generation of products on the basis of the re-configured line and the re-designed part. Joint control of the assets in the new collaboration shades into joint residual control, and thus a novel form of ownership.

Read this in light of our partial reconstruction of the history of the US automobile industry. These novel forms and instruments of organization suggest a broader corrective to the ecological views of organizational choice. Even though economic agents are aware of organizational models (albeit less fully than the theories noted above suggest), they are often much less sure about the organizational choices they face than the theories make them out to be. The reason is that the environments they face are more complex and ambiguous than the theories suppose—and more subject to non-marginal change by agents' action. Because of this deep uncertainty, actors must do as much strategizing as maximizing. (See Sabel and Zeitlin, 1997; Sabel 1996 and Zeitlin, 2000.) Under some broad range of conditions (current ones included), they must be at least as much concerned with shaping the context they are in as with pursuing what seems to be their advantage within any context.

Self-interested adjustment to conditions taken can thus proceed together with efforts to find or create a more advantageous set of constraints, in disregard of Schumpeter's classic distinction between

adaptive reactions (which accept given constraints as binding) and creative ones (which do not). (See Schumpeter, 1961, especially p. 60, and the discussion of Schumpter's ideas in Lazonick, 1983). If our re-interpretation of the Fisher Body story is correct, GM's purchase of the second chunk of Fisher stock was strategizing in this sense, as have been the surprisingly frequent shifts in supplier strategy in the auto industry generally. Just as actors will sometimes create new organizational forms when available ones are unsuited to their contexts, so they will sometimes strategize by combing existing forms in novel hybrids.

A close look at current customer-supplier relations in the US auto industry reveals many such accommodations. Ford, for example, adopts some but not all of the collaborative practices described above. It enters long-term contracts, and provides modest support for supplier development. In return it demands, and gets, information on their production processes, but not on their cost structure. Thus the contrast between standard and non-standard forms will be less stark in reality than in theory, but for reasons that the non-standard theory can digest more easily than the standard one.

To summarize: We have put forth a theory of the firm which differs from standard theory in many ways, from underlying assumptions about human cognitive processes and the nature of the environment to a characterization of the organizational processes necessary for pragmatic collaborations, and finally to conclusions about managerial actions, the significance of property rights, and the boundaries of the firm.

We begin with the assumption that firms (and the individuals within them) value collaborative learning as a valuable way to circumvent the constraints of bounded rationality, particularly when faced with high uncertainty and volatility, more than they fear the risks of opportunism associated with such

collaboration. Given that the information relevant to solving problems often resides in a wide variety of people, located both within the firm and in the broader environment, we emphasize a set of pragmatist mechanisms that insure disciplined joint inquiry -- the ongoing search for insights and new perspectives throughout the network of firms engaged in collaboration. The central goal of these mechanisms is systematically questioning routines without vitiating them as guides to action; they are called "pragmatic" because they systematically provoke doubt. Next, we identify the features of these pragmatist mechanisms that allow them both to advance knowledge effectively while also providing safeguards against opportunism that help keep the collaboration going, a phenomenon we call "learning-by-monitoring."

Dialogue within and across groups of individuals with proximate knowledge of a particular problem is, we argue, crucial to achieving the benefits of pragmatic collaborations, and therefore requires managers act more as discussion leaders than contract administrators. Under these conditions, the joint ownership of assets can lead to improved performance, counter to the predictions of the standard theory. In addition, we claim that firms faced with a large number of ongoing and potential pragmatic collaborations make decisions, under the guise of selecting which projects and which collaborators, that are really about the boundaries of the firm and reflect the firm's strategy (albeit often an emergent strategy). Boundaries are often placed (or repositioned) so that those for whom intense, frequent discussion is most productive are on the same project -- which may or may not mean within the same firm.

As mentioned above, this paper primarily contrasts the standard and non-standard views of the firm in order to address shortcomings of economic theory as applied to collaborative activity between

firms. We anticipate that future papers will address networks of firms, drawing on perspectives from economic sociology and organizational theory. This future work will argue that network theories, while strong at characterizing the characteristics of a network at one point in time, have been less successful at explicating the dynamics of networks. Our view is that the careful study of "learning-by-monitoring" through pragmatic collaboration can demonstrate how a network of firms develops and applies mutually beneficial knowledge while also being able to resolve how the gains accruing to that knowledge are distributed. From this perspective, the results of each collaborative project (i.e. an iteration in the joint inquiry that binds firms in the network together) allow predictions as to the evolution of network structure and capabilities.

Appendix 1: Data from Helper surveys of suppliers

The data come from a survey of automotive suppliers Helper conducted in spring and summer 1993. The survey was sent to the divisional director of sales and marketing at automotive suppliers in the United States and Canada. The focus of this survey was information about relationships with customers, and product characteristics. Because many companies supply their customers with several different types of products, and their relationships with their customers differ by product, respondents were asked to answer the questionnaire for their most important customer regarding one product which was typical of their company's output and with which they were familiar.

The sample chosen for the North American questionnaire included every automotive supplier and automaker component division named in the Elm Guide to Automotive Sourcing (available from Elm, Inc. in East Lansing, Michigan). This guide lists the major first-tier suppliers (both domestic and foreign-owned) to manufacturers of cars and light trucks in the United States and Canada. Each respondent who had not yet responded to the survey received three mailings over the course of 2 1/2 months.

The responses were far above the norm for business surveys. The response rate was 55 percent for the sales manager survey, after taking into account those firms which were unreachable (the surveys sent to them were returned undelivered), and those which were not eligible to answer the survey (they were not first-tier automotive suppliers, or they specialized in supplying for heavy truck and buses).

The respondents to each survey are quite representative of the population in terms of size of firm and location, as compared with data from the Elm Guide and from County Business Patterns for SICs 3714 (automotive parts) and 3496 (automotive stampings) The respondents were experienced and knowledgeable; they averaged more than 18 years in the automobile industry and more than 11 years with their company.

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