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THE ORGANIZATION OF WORK
A Comparative Institutional Assessment*

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Sociologists, radical economists, and others who claim that hierarchical modes of organization are explained by power rather than efficiency neglect transaction costs in reaching this conclusion. This is understandable, since neoclassical economics also neglects transaction costs. But it is also regrettable, since the transaction costs that arise when intermediate product is transferred across technologically separable stages of production depends crucially on organizational structure. A microanalytic assessment of alternative modes of organization entails (1) an identification of the relevant transaction cost dimensions for assessing performance, (2) a description of the organizational and operating properties of alternative modes, and (3) a comparative evaluation of alternative modes in terms of their transaction cost attributes. Transaction costs drive organizational outcomes in considerable degree.

1. Introduction

The organization of work is of long-standing interest to and elicits frequent commentary by academics, social reformers, and men of affairs (politicians, businessmen, labor leaders, bureaucrats). Although all of the social sciences have something to contribute, none would appear to have a greater stake in the issues than economics. In fact, however, the interests of economists have been of a selective kind. Partly this is because questions regarding alternative modes of internal organization do not arise naturally within, and in some respects are even alien to, the neoclassical tradition.[1] Among contemporary economists, it has mainly been those who are associated with the New Left that have pressed the issues. What appears to be a consensus position within the New Left has been summarized by Bowles and Gintis (1976, ch. 3).

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[1]Aaron Gordon's (1976, p. 3) remarks in his 1975 Presidential Address to the American Economic Association suggest as much: '...we should not ignore the extent to which rigorous formulations of the theory of the firm have had to be relaxed in order to obtain useful results in empirical work. Nor...should we forget the extent to which conventional theory ignores how and why work is organized within the firm and establishment in the way that it is'. Also, see footnote 3, infra.

The leading features of this consensus are reviewed in section 2. The argument of special interest is whether, as alleged, hierarchical modes of organization lack redeeming efficiency attributes. Assessing this is facilitated by (1) focussing on a specific production process, (2) expressly describing alternative organizational modes, across which the degree of hierarchy varies, for accomplishing the task, and (3) evaluating each mode with respect to a common set of performance attributes. Transaction costs, which have been relatively neglected in the recent literature, turn out to be central to this exercise. These efficiency issues are addressed in sections 3 and 4.

Some of the historical evidence bearing on the evolution of work modes and issues of alienation are briefly examined in section 5. Concluding remarks appear in section 6.

Very briefly, I argue that the New Left has a legitimate complaint that neoclassical economics makes little useful contact with organization of work issues. The principal reason for this is that the neoclassical firm is characterized as a production function. Economizing thus takes the form of efficient choice of factor proportions, while issues relating to the organization of work mainly involve economizing on transaction costs. The latter rarely surface, much less are prominently featured, under the production function approach.

Economizing on transaction costs involves choice among alternative modes of organization. A comparative institutional assessment of the properties of alternative modes thus supplants the conventional calculus of cost minimization. While the New Left is to be commended for recognizing the limits of the neoclassical calculus, radical economists unfortunately make very little use of systematic comparative institutional analysis. Instead, having established that neoclassical analysis is unsuited, the New Left simply asserts that non-hierarchical work modes have excellent transaction cost properties and are superior to hierarchical modes in work satisfaction respects. An examination of these assertions does not stand up to scrutiny. What is needed, and what I attempt to do, is (1) expressly identify the relevant transaction cost dimensions, (2) expressly describe the organizational and operating properties of alternative modes, and (3) perform a comparative institutional assessment. This microanalytic strategy for investigating work mode attributes would appear to have general applicability beyond the specific (and time honored) pinmaking example studied here.

2. The New Left on hierarchy

Whether hierarchy is an interesting feature of work organization — and, if so, why — is difficult to discern from examining the neoclassical theory of the firm. Paul Samuelson's remarks on the symmetry between capital hiring labor and labor hiring capital, made in the context of his assessment of

Marxian models with technological change, are illustrative. Samuelson (1957, p. 894) observes in this connection that 'in a perfectly competitive market it doesn't really matter who hires whom: so have labor hire "capital"'.

A common definition of perfect competition is that transaction costs are everywhere zero. This assures that specialized investments will never be in jeopardy because of small numbers bargaining relations that develop between parties to a transaction. As has become increasingly apparent to students of economic organization, however, many transactions for which large numbers competition exists at the outset are *transformed* into bilateral trading relations in the course of contract execution. Non-trivial transaction costs arise in this way [Williamson (1971, 1975, 1979), and Klein, Crawford and Alchian (1978)]. The hypothetical symmetry to which Samuelson refers is thus unhelpful.[2]

The empirical regularities, moreover, disclose that capitalists preponderately hire labor, rather than the reverse. Is there a sound efficiency rationale for this condition, or is hiring explained instead by considerations of power and control over political processes? Charles Lindblom's (1977, p. 105) contention that 'Not by logic but by history, owners of capital have become the owners of the enterprise' is consistent with the latter. Radical economists agree.

Original contributions by Marglin (1974) and Stone (1974) are central to the radical critique.[3] The crucial issue is whether there is an efficiency justification for hierarchy. Marglin addresses this both with reference to Adam Smith's treatment of the division of labor and in terms of the historical displacement of non-hierarchical by hierarchical modes. To the question 'What do bosses do?' Marglin offers the reply: bosses exploit workers and hierarchy is the organizational device by which this result is accomplished.

Whether the organization of work is usefully addressed in the context of pinmaking is arguable. T.S. Ashton, among others, considers the example regretable.[4] Inasmuch as pinmaking is neither economically important nor

[2]As Marglin (1974, pp. 45–46) points out, the idealized assumptions of perfect competition on which Samuelson relies leaves 'no scope for supervision and discipline except for that imposed by the market mechanism. Any recognition of the importance of supervision and discipline as motivating forces between the establishment of factories is tantamount to admission of important violations of the assumptions of perfect competition'. Except as incumbent workers enjoy advantages over outsiders (by reason, presumably, of firm-specific experience) there would be no need for 'supervision and discipline' beyond that imposed by the market.

[3]See Bowles and Gintis (1976, ch. 3) for a summary of the radical arguments where the Marglin and Stone papers are prominently featured.

[4]Ashton (1925, p. 281) observed that 'In text-books and examination scripts the pin trade of a hundred or more years ago has been given a prominence which is far from justified by its true rank among economic activities. Babbage notwithstanding, the manufacture of pins does not afford the ideal illustration of the division of labor; and one may echo Dr. Clapham's regret "that Adam Smith did not go a few miles from Kirkcaldy to the Carron Works to see them turning and boring their cannonades instead of to his silly pin factory"'.

technologically interesting, this is understandable. But the pinmaking example has several advantages. For one thing, the technology is simple. Not only are the tasks and tooling relatively uncomplicated, but successive stages of pinmaking are technologically separable. There is no occasion, therefore, to disallow certain types of non-hierarchical work modes at the outset because of the 'imperatives of technology'. Instead, a wide range of organizational modes are technologically feasible and transactions rather than technology are determinative.

Secondly, the pinmaking example has the advantage of being already familiar to social scientists. Indeed, it would be difficult to cite another case where the economies that accrue to the specialization of labor are thought to be so clearly established. Not only does Smith discuss the production process in detail, but Babbage (1835, pp. 175–183) and Ashton (1925) give even more complete descriptions. Third, and related, although Smith's use of the pinmaking example to illustrate the advantages of the specialization of labor was long thought to be uncontroversial, Marglin argues that Smith's discussion of alternative modes for organizing pinmaking is incomplete and is biased in favor of hierarchy. Whether pinmaking ought to be organized hierarchically is thus actively open to dispute.

Smith's discussion of the division of labour in the context of pinmaking is worth recounting in detail. He [Smith (1904, pp. 6–7)] observed that

> '...in the way in which this business is now carried on, not only the whole work is a peculiar trade, but it is divided into a number of branches, of which the greater part are likewise peculiar trades. One man draws out the wire, another straights it, a third cuts it, a fourth points it, a fifth grinds it at the top for receiving the head; to make the head requires two or three distinct operations; to put it on, is a peculiar business, to whiten the pins is another; it is even a trade by itself to put them into the paper; and the important business of making a pin is, in this manner, divided into about eighteen distinct operations, which, in some manufactories, are all performed by distinct hands, though in others the same man will sometimes perform two or three of them. I have seen a small manufactory of this kind where ten men only were employed, and where some of them consequently performed two or three distinct operations. But though they were very poor, and therefore but indifferently accommodated with the necessary machinery, they could, when they exerted themselves, make among them about twelve pounds of pins in a day. There are in a pound upwards of four thousand pins of a middling size. Those ten persons, therefore, could make among them upwards of forty-eight thousand pins in a day. Each person, therefore, making a tenth part of forty-eight thousand pins, might be considered as making four thousand eight hundred pins in a

> day. But if they had all wrought separately and independently, and without any of them having been educated to this peculiar business, they certainly could not each of them have made twenty, perhaps not one pin in a day.'

The factors that are responsible for the advantages attributable to the division of labor are identified by Smith (1904, p. 9) as follows:

> 'This great increase of the quantity of work, which, in consequence of the division of labour, the same number of people are capable of performing, is owing to three different circumstances; first, to the increase of dexterity in every particular workman; secondly, to the saving of the time which is commonly lost in passing from one species of work to another; and lastly to the invention of a great number of machines which facilitate and abridge labour, and enable one man to do the work of many.'

Several things are noteworthy about these observations. For one thing, Smith is imprecise about the organizational and ownership relations that exist among the workmen in the small factory in question, though one may infer that the workmen were subject to an authority relation and that the plant and equipment was owned by a capitalist owner–manager who directed the work. Second, only a single alternative to factory organization of the kind described is considered. The alternative is for each man to work 'separately and independently', each pin being crafted separately, start to finish, before work on the next is begun. Intentionally or not, the comparison is thereby rigged in favor of factory modes of organization.

As Marglin (1974, p. 38) points out, the separate crafting of each individual pin is absurd. Both dexterity and set-up time economies can be realized by substituting batch processing for separate crafting: 'It appears to have been technologically possible to obtain the economies of reducing set-up time *without* specialization. A workman, with his wife and children, could have proceeded from task to task, first drawing out enough wire for hundreds or thousands of pins, then straightening it, then cutting it, and so on with each successive operation, thus realizing the advantages of dividing the overall production process into separate tasks.' Indeed, in Marglin's (1974, p. 34) view, 'The capitalist division of labor, typified by Adam Smith's famous example of pin manufacture, was the result of a search not for a *technologically* superior organization of work, but for an *organization* which guaranteed to the enterpreneur an essential *role* in the production process, as integrator of the separate efforts of his workers into a marketable product' (emphasis added).

The familiar neoclassical production function framework, whereby economizing is accomplished mainly by equating marginal rates of

transformation with relative factor prices, is simply inimical to the proposition that organization form matters. To assess this, a transaction cost orientation is needed. Specifically, holding technology constant, the issues are whether transaction cost savings are realized by organizing one way rather than another and, if so, how are these to be valued. The success of the factory (hierarchy) over the putting-out system is described by Marglin (1974, p. 46) as follows (emphasis in original):

> '...the agglomeration of workers into factories was a natural outgrowth of the putting-out system (a result, if you will, of its internal contradictions) whose success had little or nothing to do with the technological superiority of large-scale machinery. The key to the success of the factory, as well as its aspiration, was the substitution of capitalists' for workers' control of the production process; discipline and supervision could and did reduce costs *without* being technologically superior.'

Additional or related productivity advantages of hierarchy, as compared with the putting-out system, are that hierarchy permits the benefits of innovation to be appropriated more completely [Marglin (1974, p. 48)] and serves to check 'embezzlement and like deceits' (p. 51).

Despite productivity and efficiency consequences of these kinds, radical economists take the position that hierarchy lacks redeeming social purpose. For one thing, productivity gains that are attributable to discipline are involuntary. The disutility of work presumably more than offsets the output gains which result from discipline.[5] Secondly, although hierarchy may check transactional disabilities associated with non-hierarchical modes, these disabilities are evidently thought to be unimportant or are explained by institutional defects of a remediable kind. As an example of the latter, Marglin (1974, p. 49) contends that the patent system could be reshaped in ways which vitiate the innovative advantages which the patent system currently assigns to hierarchy. Accordingly, his (p. 33) answer to the question 'Is hierarchical authority really necessary to high levels of production?' appears mainly to be negative: although hierarchy may favor the accumulation of capital (p. 34), the coupling of the hierarchical organization of work with an extensive division of labor is artificial and has as its object the exploitative purpose of '"divide and conquer" rather than efficiency' (p. 39).

Not only does the New Left argue that hierarchy lacks a compelling efficiency rationale, but it further contends that the history of hierarchy

[5]This neglects the possibility that the benefits of supervision are perceived by the workers and that supervision is imposed by mutual consent so as to check free riding among the membership of an interdependent work force. Alchian and Demsetz (1972) motivate what they refer to as the 'classical capitalist firm' on such mutual consent grounds.

supports the alternative hypothesis, namely, hierarchy arose in the service of capitalist power over labor. Stone's (1974) interpretation of the transformation of the steel industry in the late 19th century develops this argument in a way that both Bowles and Gintis (1976) and Marglin (1977) find compelling. Also, the New Left takes the position that not only are non-hierarchical work modes more efficient, but they result in greater work satisfaction [Bowles and Gintis (1976, pp. 78–81)].

These latter two issues are briefly addressed in sections 5 and 6. But the crucial issue, and my main interest, involves an assessment of alternative work modes in transaction cost terms. If, as alleged, hierarchy does not service efficiency purposes, the power relationship hypothesis is more compelling. If, however, hierarchy serves to economize on transaction costs, then an alternative explanation for the historical events to which Marglin and Stone refer warrants serious consideration. Additionally, possible tradeoffs between transactional efficiency and worker alienation may need to be faced. I turn, therefore, to an examination of alternative modes assessed in transaction cost terms.

3. The microanalytic approach

3.1. Efficiency

Consistent with the production function orientation of received microtheory, the prevailing tendency in economics is to attribute efficiency differences to differences in technology. Technologies for which a large number of workers are required to work coordinately at a single station are implicitly assumed to be very common. Joining these workers under an employment relation is thought to be the 'natural' way to organize production. What is referred to as the firm is then the outcome of these underlying technological conditions.

In reality, however, most large firms are not large, single station facilities. Instead, large size is the result of joining a series of stations, across which intermediate product is successively passed, within a single administrative entity.

In principle, the interfaces between successive stations could be mediated by market exchanges. That such market mediated exchanges are supplanted by an administrative process is a *prima facie* indication that internal organization serves to economize on transaction costs that would otherwise be incurred in the market. Vertical integration is thus to be understood principally in transaction cost rather than technological terms [Williamson (1975, chs. 4–5)].

Transferring a transaction (or related set of transactions) out of the market into the firm still leaves open, however, the matter of how these transactions

are going to be organized internally. Two propositions are relevant in this connection: (1) just as market structure matters in assessing the performance properties of market organization, so does internal structure matter in assessing the efficacy of alternative internal modes, and (2) transaction costs are central to performance assessments of both kinds. Accordingly, holding the degree of vertical integration constant, the choice between alternative internal modes for organizing successive stages of production turns mainly on transaction cost rather than technological considerations.

I do not by this, however, mean to imply that choices of technology and internal organization are independent. To the contrary, technological changes may render some organizing modes inoperable. But as between *feasible* organizing modes (of which there are normally several), differential performance is to be understood as a transaction cost issue.

Basically, the question of efficient versus inefficient modes of internal organization comes down to an examination of their properties in bounded rationality and opportunism respects. Organizing modes that economize on scarce information processing and decision-making capability have superior properties in transaction cost terms, *ceteris paribus*. Similarly, modes that serve to attenuate subgoal pursuit and discourage information hoarding and distortion are favored, *ceteris paribus*. Economizing on bounded rationality and attenuating opportunism are thus the core issues on which a comparative assessment of transaction costs turns.

3.2. A description of alternative modes

Marglin contends that the non-experimental nature of the social sciences contributes to the continuing neglect of internal organization. Were this not the case, alternative modes of organization, including egalitarian work modes, would be designed and tested experimentally [Marglin (1974, pp. 33–34)]. While I agree that experimental testing of this kind has great merit, I submit that a great deal can be discovered about the efficacy of alternative work modes by an abstract assessment of their transactional properties. At the very least, a priori analysis of the transactional attributes of alternative modes should permit the empirical issues to be greatly delimited.

So that alternative modes will be on a parity in technological and locational respects, it will be useful first to specify the common manufacturing characteristics associated with each. One of the more serious problems with the work mode literature is that such assumptions are rarely made explicit.

The following assumptions will be maintained in this and the next two sections and, except where noted to the contrary, will apply across all modes:

(1) Specialized equipment, provided that it can be utilized at design capacity, facilitates low cost pin manufacture.

(2) Workers acquire dexterity by repeated operations of the same kind, though this is subject to diminishing returns.
(3) It is economical, so as to economize on transportation expense, that all pinmaking operations be completed at a common location, whence, the putting-out system excepted, all work is performed under one roof.
(4) The common building is leased and, whatever the station ownership and utilization arrangements, no problems arise with respect to building lease payments.
(5) Successive stages of manufacture are separable in the sense that placing a buffer inventory between them permits work at each stage to proceed independently of the other.
(6) The production line is balanced in the following very special sense: work stations are designed such that, absent untoward events, a steady flow of intermediate product between stations is assured by placing a single, fully occupied worker at each station.
(7) Market transactions for intermediate product are very costly.
(8) The workers employed under each mode are a random sample of the technically qualified population of which they are a part.
(9) Replacement investment occurs routinely and investment for expansion purposes is ignored.

The first four assumptions are relatively uncontroversial. The fifth assumption (separability) means that differences among work modes turn on transactional rather than technological considerations. Coupling this with the one-man-each station condition [assumption (6)] effectively means that the technology associated with the putting-out system is not inferior; rather, the same technology is feasible for and is common to all modes.

As noted, this one-man-each station assumption is very special. It serves to concentrate attention on transaction cost issues, which have hitherto been neglected, and suppress technological considerations, the importance of which has previously been exaggerated. Redressing this imbalance by way of the one-man-each station device scarcely yields a 'representative' outcome. It is nevertheless noteworthy that the very same transaction cost attributes of work organization which this device serves to isolate also appear in the multiperson station context. The assumption will accordingly be retained throughout the paper.

The assumption that intermediate product markets work badly permits us to focus entirely on the transactional properties of *internal* organization. Were it that market alternatives to internal exchange could be exercised at slight cost, choice among alternative internal modes becomes less important — since market relief can always be obtained when internal modes threaten to break down. Assumption (7) forecloses this possibility.

The assumption that the workers employed under each mode are a random sample of the population precludes the possibility that workers will match preferences toward work modes in a discriminating way. Thus although certain work modes may be competitively viable if they are staffed with workers with *special* attributes, this is foreclosed by the random assignment stipulation wherein all modes are assessed with respect to a common workforce.

Assumption (9) permits new investment issues to be set aside; attention is focused on the operating and adaptive attributes of alternatives modes instead. This has two advantages. First, the investment properties of alternative ownership arrangements can be and have been investigated within the neoclassical framework. The studies of Vanek (1970), Meade (1972), and Furubotn (1976), all confirm that collective ownership models are beset with investment problems. Secondly, the operating and adaptive attributes of alternative work modes have been relatively neglected in the prior literature. Omitting investment from the performance attributes under scrutiny serves to compensate for this imbalance.

So much for the assumptions; I turn now to a description of alternative modes. Six different modes are described, first in ownership and then in contracting terms. Both for transaction cost purposes and for purposes of studying hierarchy, the latter is more basic. Ownership, however, is the more familiar way of describing work modes and will be employed first.

3.2.1. Alternative modes/ownership

Three types of station ownership relations — entrepreneurial, collective ownership, and capitalist — with two variants within each will be considered.

(*a*) *Entrepreneurial modes*

Entrepreneurial modes are ones in which each station is owned and operated by a specialist.

(*i*) *Putting-Out system.* A merchant-coordinator here supplies the raw materials, owns the work-in-process inventories, and makes contracts with the individual entrepreneurs, each of whom performs one of the basic operations at his home using his own equipment. Material is moved from station to station (home to home) in batches under the direction of the merchant-coordinator.

The Putting-Out system has been described by Landes (1966, p. 12) as follows:

> '... merchant-manufacturers "put out" raw materials — raw wool, yarn, metal rods, as the case might be — to dispersed cottage labor, to be

worked up into finished or semifinished products. Sometimes the household was responsible for more than one step in the production process: spinning and weaving were a typical combination. But the system was also compatible with the most refined division of labor, and in the cutlery manufacture of Solingen or Thiers or in the needle trade of Iserlohn, the manufacturing process was broken down into as many as a dozen stages, with each cottage shop specializing in one. Putting-Out was a major step on the path to industrial capitalism. For one thing, it brought industrial organization closer to the modern division between employers who own the capital and workers who sell their labor. To be sure, most domestic weavers owned their loom and nailers their forge. They were not, however, independent entrepreneurs selling their products in the open market; rather they were hirelings, generally tied to a particular employer, to whom they agreed to furnish a given amount of work at a price stipulated in advance.'

(*ii*) *Federated.* Stations are here located side by side in a common facility. Intermediate product is transferred across stages according to contract. So as to avoid the need for supervision or continuous coordination, buffer inventories are introduced at each station. Subject to the condition that buffer inventories do not fall below prescribed levels, in which event penalties are assessed, each worker proceeds at his own pace.

Whether this mode was ever widely used is uncertain and perhaps doubtful. Thus although Landes (1966, p. 14) observes that the practice of 'leasing space and power in a mill to individual artisans, each conducting his own enterprise' was common in nineteenth century England, it is unclear whether intermediate product was traded among stations or if each station was self-contained.

It is nevertheless useful to consider the Federated mode as an evolutionary development, even if only of a hypothetical kind. For one thing, it illustrates the use of comparative analysis of a microanalytic kind to investigate the properties of new forms of organization. Once an abstract mode has been described, its incentive and contracting properties, in relation to other modes, are relatively easy to establish. Additionally, the Federated mode has the attractive property that it preserves considerable worker autonomy.[6] Egalitarian work relations are presumably favored in the process.

[6]An alternative mode, of a less autonomous kind, would be to transfer the Putting-Out mode into the factory. Thus instead of each work station striking contracts with predecessor and successor stations, all contracts would be mediated instead by a central agent — the merchant-coordinator. Since, except in transportation expense respects, the simple efficiency properties of this mode are substantially identical to those of the Putting-Out system, the Federated mode, with bilateral contracting between stations, has more interesting properties. [Freudenberger and Redlich (1964, p. 394) conjecture that 'Very probably the first consolidated, centrally managed workshops were little more than concentrated Putting-Out arrangements'.]

(b) *Collective ownership*

Work stations are here owned in common by the entire group of workers.

(i) *Communal-emh.* Although stations are owned in common, every man has a claim to the output associated with his own labors. So as to facilitate the acquisition of dexterity and economize on set-up costs, each worker engages in batch process manufacture. The orderly movement of product is accomplished by having workers move between successive stations at prescribed intervals (hourly, daily, weekly, or whatever appears most appropriate), each bringing his own work-in-process inventory with him and selling his final product in the market.

The suffix 'emh' is used to emphasize that this is an every-man-for-himself system.[7] Thus although workers pool their resources with respect to the ownership of plant and equipment and orderly station moves are accomplished by calendar, there is no specialization among workers. Such a joining of common ownership with an every-man-for-himself rule is what Demsetz (1967, p. 54) has described elsewhere as the communal mode. Unsurprisingly, the combination of community ownership with emh appropriability leads to mixed performance results. To conclude, however, that collective ownership is inferior to private ownership because of defects in the Communal-emh mode is unwarranted. If collective modes, such as the Peer Group, can be devised that have better properties than does Communal-emh, these presumably should be considered.[8]

(ii) *Peer Groups.* The same ownership arrangement obtains here as in the Communal-emh mode, but workers are compensated not on the basis of their own product but are paid the average product of the group instead.[9] Workers may rotate among stations or specialize at one or a few stations. Moreover, so as to avoid the need for full group discussion whenever an adaptation needs to be made and/or to better assure corrdination among the members with respect to work breaks, variable rates of production, and the like, Peer Groups may elect temporary 'leaders', who make operating — but not strategic — decisions on behalf of the group. It is important, however, that leadership rotate among group members if rigid hierarchical relations are to be avoided. Mandel's (1968, p. 677) proposal for self-management 'in

[7]Alternatively, the suffix 'eph/h' could be used, where this refers to every-person-for his/herself. For purposes of economy, I use emh.

[8]Demsetz was concerned with land use rather than batch manufacturing in his discussion of communal ownership. I conjecture that the Peer Group typically has superior properties to the Communal-emh mode for land use as well.

[9]Specifying average group product is unnecessary. Any of a variety of non-marginal product reward schemes will do.

which everybody will take a turn to carry out administrative work in which the differences between 'director' and 'directed' will be abolished' is in this spirit. The joining of a non-marginal productivity sharing rule with democratic decision-making is what characterizes Peer Group organization.[10]

(c) *Capitalist modes*

Inventories of all kinds (raw materials, intermediate product, finished goods) as well as plant and equipment are owned by a single party under capitalist modes.

(*i*) *Inside Contracting.* The Inside Contracting mode of organization has been succinctly described by Buttrick (1952, pp. 201–202) in the following way:

> 'Under the system of inside contracting, the management of a firm provided floor space and machinery, supplied raw material and working capital, and arranged for the sale of the final product. The gap between raw material and finished product, however, was filled not by paid employees arranged in [a] descending hierarchy... but by [inside] contractors, to whom the production job was delegated. They hired their own employees, supervised the work process, and received a [negotiated] piece rate from the company.'

The Inside Contracting system permits a capitalist who has relatively little technical knowledge to employ his capital productively while limiting his involvement to negotiating contracts with inside contractors, inspecting and coordinating the flow of intermediate product, and taking responsibility for final sales.[11]

(*ii*) *Authority Relation.* The Authority Relation mode involves capitalist ownership of equipment and inventories coupled with an employment relationship between capitalist and worker. The employment relation is, by design, an incomplete form of contracting. Flexibility is featured as the employee stands ready to accept authority regarding work assignments provided only that the behavior called for falls within the 'zone of acceptance' of the contract. Joining an organization under the Authority Relation mode thus entails an agreement 'that within some limits (defined both explicitly and implicitly by the terms of the employment contract) [the employee] will accept as premises of his behavior orders and instructions supplied to him by the organization' [March and Simon (1958, p. 90)]. Rather than enjoy the

[10] For an elaboration, see Williamson (1975, ch. 3).

[11] For an evaluation of the limits of Inside Contracting, see Williamson, (1975, pp. 96–99).

contractual autonomy of an inside contractor, who is subject to only very loose performance constraints (e.g., that minimum quality standards be met and that buffer inventories not fall below prescribed levels more than a certain percentage of the time), the worker now is subject to much more detailed supervision.

3.2.2. *Alternative modes/contracting*

Contractual differences of two kinds should be distinguished. The first and more important compares alternative modes in terms of their degree of reliance on contractual detail to coordinate production. This is the distinction emphasized here and in section 4. The second has reference to the bargaining relation between the contracting agents. This aspect is examined in section 3.3 below.

The six alternative modes under examination in this paper differ significantly in the degree to which they rely on comprehensive contracting. For three of the modes, contracting (and recontracting) is the exclusive basis by which product is exchanged and interfaces are brought into adjustment. For the other three modes, contract is used to provide framework, which framework is subject to renegotiation at the contract renewal interval. Within the context of this framework, however, day-to-day operations are governed by an administrative process. These two different styles of organization will be referred to as continuous contracting and periodic contracting, respectively.

(*a*) *Continuous contracting*

Both types of entrepreneurial modes (Putting-Out and Federated) as well as the Inside Contracting mode rely extensively on contracting. The putter-outer and the capitalist serve as the common contracting agent in the first and third instances while the workers in the Federated mode engage in bilateral contracts with the owners of predecessor and successor stations. A common characteristic of contracting modes is that each worker maintains considerable autonomy and, once the terms of the contract are struck, lays claims to a distinct profit stream. Since the gains of one agent are frequently made at the expense of another, relations among the parties are of a highly calculative kind.

The problems with such contracting modes are of two kinds. First, can the requisite complex contract be described, negotiated, and enforced in a low cost manner? Bounded rationality considerations preclude comprehensive contracting from being realized. Confronted with the infeasibility of such complete contracting, the hazards of incomplete contracting then need to be addressed.

Since bargaining relations between successive stations are necessarily of a small numbers kind, bilateral monopoly problems abound. To be sure, a long-term, recurring relationship between the parties is contemplated. Unrestrained, myopic subgoal pursuit is accordingly discouraged. But it is unrealistic to expect autonomous parties to adapt to unforeseen, hence unplanned, circumstances in a joint profit maximizing way without first settling their respective claims on profit streams through intensive, self-interested bargaining. The prospect and actuality of such recurrent bargaining is a major impediment to autonomous contracting work modes.

(*b*) *Periodic contracting*

There is no exchange of intermediate product among members of Communal-emh firms, whence there is little occasion for contracting under this mode. *Ad hoc* contracts might, however, be negotiated if workers were to become disabled, since work-in-process inventories would otherwise stand idle. Also, original investment, re-investment, and maintenance agreements will need to be worked out. Although these are not trivial matters, the problems of recurring contracting which arise in connection with day-to-day operations in each of the above described contracting modes do not appear.

Members of Peer Groups have even less need for contracting. Work left undone by a disabled worker would be completed by his associates. To be sure, membership affiliation and disaffiliation terms would have to be reached. But no bilateral contracting between successive stations on operating matters would occur. Democratic decision-making, effected by the rotating leader or by full group discussion, is used to bring station interfaces into adjustment.

Contracting under the Authority Relation is apt to be somewhat more complete, in that explicit and implicit understandings regarding the zone of acceptance of the employment relation [Barnard (1962), Simon 1957)] need to be reached. Once agreement has been reached, however, this is an essentially non-contractual mode. Adaptations of an operating kind are made within the framework of this rather general contract, whereby boss and worker essentially agree to 'tell and be told'. And strategic decisions affecting the overall configuration of the enterprise are mainly left to the boss's discretion.

3.3. The degree of hierarchy

The degree of hierarchy is usually assessed in decision-making respects. Where the responsibility for effecting adaptations is concentrated on one or a few agents, hierarchy is relatively great. Where instead adaptations are taken by individual agents or are subject to collective approval, hierarchy is slight. A less common but nonetheless useful way to characterize hierarchy is in

contractual terms. If one or a few agents are responsible for negotiating all contracts, the contractual hierarchy is great. If instead each agent negotiates each interface separately, the contractual hierarchy is weak.[12] Although there is a strong, positive rank correlation between these two ways of characterizing hierarchy for the work modes investigated here, the correlation is not perfect. What is perhaps more interesting is that ownership is imperfectly correlated with hierarchies of both kinds. Using E, Co, and Cap to denote Entrepreneurial, Collective and Capitalist modes respectively and using brackets to denote ties (or near ties), the rank ordering of modes from least to most hierarchical in contractual and decision-making respects is as follows:

Degree of hierarchy (least to most)

Contractual	Decision-making
(1) Federated (E) Communal-emh (Co) Peer Group (Co)	(1) Federated (E) Communal-emh (Co)
(2) Putting-Out (E)	(2) Putting-Out (E) Inside Contracting (Cap)
(3) Inside Contracting (Cap) Authority Relation (Cap)	(3) Peer Group (Co)
	(4) Authority Relation (Cap)

There is no central contracting agent in the Federated, Communal-emh, or Peer Group modes of organization, whence a contractual hierarchical relationship is altogether absent for these. By contrast, there is a central agent for the other three modes. Although characterizing the hierarchical relation between central agent and workers is not simple, a plausible case for the relations shown between Putting-Out, Inside Contracting, and the Authority Relation can be made in terms of bargaining strength of the workers vis-à-vis the central agent at the contract renewal interval. This varies with (1) the extent to which workers have acquired firm-specific skills and knowledge, (2) collective organization among workers, and (3) physical asset ownership.

Skill acquisition is the same under all three periodic contracting modes, since each involves specialization in identical degree. Collective organization may be slightly stronger under the Authority Relation, since workers here are less autonomous than under Putting-Out (where they are dispersed) and Inside Contracting (where they appropriate separate profit streams). Physical

[12]Note in this connection that the term contractual hierarchy has reference to the relation between the contracting agents, not to the reliance on contracting to effect adaptations. Modes that are described above as periodic may (and some do) have strong hierarchical properties at contract renewal intervals.

assets are owned by each worker under Putting-Out, but the central agent owns the stations in both instances under the Authority Relation and Inside Contracting. The upshot is that the contractual hierarchy is weak for Putting-Out, while the Authority Relation and Inside Contracting are somewhat stronger in contractual hierarchy respects.

Consider now the decision-making hierarchy. There is no command relation whatsoever between the members of the Federated and Communal-emh modes. The former is governed by rules and bilateral contractual relations; the latter is governed by rules and democratic decision-making. A relatively weak command relation exists for Inside Contracting and the Putting-Out modes. The central agent to the contracts can appeal to the workers to adapt in coordinated ways to changed circumstances, but the contracts govern as responsibility for operating matters has been extensively delegated. Thus bargaining and bribes may be needed if interim changes favored by the central agent are to be effected. The Peer Group acknowledges the benefits of a command structure by designating a leader to coordinate day-to-day affairs. The leadership position turns over regularly, however, and strategic decisions are reached only after a full group discussion. Democratic decision-making effectively prevails. The Authority Relation posits at the outset that a superior-subordinate relation will govern in both operating and strategic respects. To be sure, the zone of acceptance of the employment relation, within which workers will accept orders without resistance, is limited by formal and informal agreement. But a command hierarchy is a prominent feature of the Authority Relation.

Although capitalist modes are more hierarchical than are collective ownership modes from a contractual point of view, the more critical hierarchy for performance purposes is the decision-making hierarchy. The observed relation between ownership and hierarchy is very weak in decision-making respects. The least hierarchical modes, Federated and Communal-emh, are of different ownership kinds (entrepreneurial and collective ownership, respectively). The Peer Group, Putting-Out, and Inside Contracting modes have intermediate degrees of hierarchy and each is from a different ownership class. Although the most hierarchical decision-making mode is a capitalist mode, the next strongest command hierarchy features collective ownership.

4. Efficiency properties of alternative modes

The issue to be addressed here is, socioeconomic attributes of the enterprise aside, do alternative work modes differ systematically in efficiency respects? A set of simple efficiency criteria are proposed first. Crude rankings of work modes with respect to these criteria are then attempted.

4.1. Simple efficiency criteria

None of the eleven efficiency measures described below is unfamiliar. Not only will each be recognized as a relevant efficiency dimension, but, at one time or another, the ramifications of each for the organization of work have been discussed previously by others. What has been missing is an overview of the issues. No single mode has been systematically assessed with respect to all of the eleven criteria. Neither has there been an effort to make comparisons across modes in terms of these criteria.

The eleven efficiency indicators are usefully grouped into three types: attributes associated with the flow of product, the efficiency with which workers are assigned to tasks, and the incentive properties of alternative modes. Note that each of the eleven performance statements that follow is of a *ceteris paribus* kind.

(*a*) *Product flow*[13]

Transportation expense, buffer inventory requirements, and the 'leakage' of product at successive processing stages are the matters to be evaluated here.

(*i*) *Transportation expense.* The physical transport of work-in-process inventories from one station to the next is costly. *Ceteris paribus*, modes which economize on transportation expense are favored.

(*ii*) *Buffer inventories.* Temporal separability between successive work stations is effected by creating a buffer inventory. Modes which economize on the level of these inventories are favored.

(*iii*) *Interface leakage.* Interface leakage has reference to actual or effective losses of product during manufacture. Modes which at low cost discourage embezzlement and/or the disguise of the true quality attributes of intermediate product as product is transferred across stages are favored.

(*b*) *Assignment attributes*

Assignment issues of three kinds arise. First, there is the matter of assigning workers to work stations. Second is the issue of leadership. Third is the matter of contracting with nonoperating specialists.

(*i*) *Station assignments.* Talents will be effectively utilized to the extent that workers are assigned to tasks for which they are relatively well suited. This is a specialization of labor issue. In the normal case where workers are not equally skilled in every task, modes that make discriminating job assignments on the basis of comparative advantage are favored.

[13]These product flow economies are often advanced as the reason for supplanting the Putting-Out system by the factory. See Babbage (1835, pp. 135, 213, 219) and Freudenberger and Redlich (1964, p. 395). As described below, however, there is much more to it than this.

(*ii*) *Leadership.* Modes vary in the degree to which coordination is required and the efficacy with which leadership assignments are made. Modes which economize on coordination needs and make discriminating leadership assignments are favored.

(*iii*) *Contracting.* The capacity to aggregate demands and contract with specialists which service the needs of many stations (e.g., maintenance specialists)[14] is the issue here. Modes in which such contracting is easily accomplished are favored.

(*c*) *Incentive attributes*

Differential steady state and intertemporal incentives give rise to performance differences. Of special interest are:

(*i*) *Work intensity.* Work intensity refers to the amount of productive energy expended on the job. Modes which discourage workers from malingering are favored.

(*ii*) *Equipment utilization.* The issue here is whether equipment is utilized with appropriate care. Modes which disfavor equipment abuse and neglect are favored.

(*iii*) *Local shock responsiveness.* Local shocks are those which affect an individual work station. Work stoppages due to machine breakdown or worker illness are examples. Modes which facilitate quick recovery are favored.

(*iv*) *Local innovation.* Local innovations involve process improvements at individual stations. Modes that promote local cost economizing process changes are preferred.

(*v*) *System responsiveness.* The capacity to respond to system shocks and to recognize and implement system innovations (of process, product, or organizational kinds) are the matters of interest here.[15] Modes that adapt easily to changing market circumstances and which permit systems improvements to be made without requiring extensive contract renegotiation are favored.

[14]Among the advantages of the factory identified by Baines (1835, p. 460) and Babbage (1835, pp. 214–215) was the fact that it allowed specialists to perform maintenance functions on a number of machines in a single location.

[15]These could be treated as separate performance categories. As it turns out, the rankings of modes across system shock and system innovation dimensions are substantially identical, whence the composite system responsiveness category.

4.2. *Efficiency ratings*

Although there are some dimensions for which best or worst efficiency ratings are easily made (e.g., the Putting-Out mode has the worst transportation expense features; the Communal-emh mode, where workers move successively across stations and appropriate the fruits of their own labors, has the best work intensity and interface leakage properties but is worst in equipment utilization respects; the Authority Relation has the best system responsiveness properties; etc.), there is little to be gained by using a four-fold ranking system (best, good, poor, worst) rather than a simpler bivariate ranking in which best or good modes are assigned the value 1 and poor or worst modes are rated 0.[16]

Bivariate assignments for each of the simple efficiency dimensions are reported in table 1, where modes are grouped according to ownership type. Although a detailed rationale for the assignments is not attempted here, one is reported elsewhere [Williamson (1976, pp. 30–50)]. I submit, however, that most of the assignments are transparent or are evident from the discussions of ownership comparisons and contracting comparisons that appear below.

(*a*) *Ownership comparisons*

Putting-Out and Federated modes, which are the entrepreneurial ownership modes, have rather poor product flow attributes, mixed assignment attributes, and are indistinguishable in incentive respects. Inasmuch as the Federated mode involves concentrating work stations at a common location, transportation expense economies are realized over the Putting-Out mode. Buffer inventories for each mode are high, however — though the reasons differ. For the Putting-Out mode, inventories are high because each station works on its own schedule (subject to daily or weekly output agreements) and product is moved in discrete shipments. Buffer inventories are high for the Federated mode so as to reduce the temporal dependence on predecessor stages, which are linked by bilateral contracts. Small buffer inventories would predictably result in numerous disputes if, as is commonly the case, it is costly to assess responsibility for delivery failures.

Interface leakage for both entrepreneurial modes is high. Chronic theft and quality problems are reported in connection with the Putting-Out mode [Babbage (1835, pp. 135, 219), Freudenberger and Redlich (1964, p. 395), and Marglin (1974, p. 51)]. Theft is not a problem with the Federated mode, but quality control is. Not only is there an incentive for each stage to shade

[16]For an earlier rating scheme in which the four-fold assignments were used, see Williamson (1976). For earlier efforts to assess the efficiency of alternative organizing modes by rank ordering their efficiency properties, see Udy, Jr. (1970) and Sen (1975, ch. 3). Both are concerned with broader economic development issues (Udy from an anthropological point of view) than are of concern to me here; and both are of limited immediate relevance to an assessment of batch process manufacturing — though Sen might be extended in this direction.

Table 1

Simple efficiency properties of alternative modes, ownership grouping.

Mode	Product flow attributes			Assignment attributes			Incentive attributes				
	Transportation expense	Buffer inventories	Interface leakage	Station	Leadership	Contracting	Work intensity	Equipment utilization	Local responsiveness	Local innovation	System responsiveness
Entrepeneurial											
Putting-Out	0	0	0	1	1	0	1	1	0	1	0
Federated	1	0	0	1	0	0	1	1	0	1	0
Collective											
Communal-emh	1	0	1	0	1	0	1	0	0	0	0
Peer Group	1	1	1	0	0	1	0	1	1	1	1
Capitalist											
Inside Contracting	1	0	0	1	1	1	1	0	0	1	0
Authority Relation	1	1	1	1	1	1	0	1	1	0	1

quality, but there are complex attribution problems when complaints are registered.[17]

The Putting-Out mode has leadership advantages over the Federated mode since there is a central contracting agent. The dispersed location of the stages, however, makes it difficult for leadership to be exercised in contracting, local responsiveness, or system responsiveness respects — whence Putting-Out is rated no better than Federated on these dimensions.

The two collective ownership modes have generally good product flow attributes, rather poor assignment properties, and very different incentive properties. The Communal-emh mode has higher buffer inventory requirements, since each worker moves successively across all stages, taking his own work-in-progress inventory with him. Assuming that setup costs are not negligible, each worker will remain at each stage for a considerable period. Inventory requirements, thus, are correspondingly great.

The Communal-emh mode has excellent work intensity incentives, since every worker appropriates the fruits of his own labors. The Peer Group, by contrast, is subject to free rider abuses. (Although careful screening of candidates for Peer Group membership could serve to check such abuses, this would violate the random assignment assumption.) In other respects, however, the Peer Group has superior incentive properties to the Communal-emh mode. This is because the Peer Group is a cooperative mode whereas the Communal-emh mode is given to aggressive suboptimization.

Such suboptimization is especially evident in the case of equipment utilization. The benefits attributable to careful utilization of equipment are realized mainly by others while the costs of intensive or careless utilization are shifted mainly to others; adverse incentives proliferate. A complex bargain would have to be struck and policed to alter this adverse outcome. Peer Group members, by contrast, experience no such myopic equipment use incentives. The suboptimization versus cooperative aspects of these two modes explain other incentive differences as well.

The Authority Relation has superior product flow attributes to the other capitalist mode, Inside Contracting. Absent penalties on excess work-in-process inventories, contractors have the incentive to accumulate such inventories so as to realize greater operating autonomy. By contrast, the Authority Relation does not need to rely on pecuniary penalties to move inventories: fiat will do. And it can carry low inventories because of its superior responsiveness attributes. Interface leakage is also a problem with

[17]Thus if putting a head on a pin depends on the manner in which wire is drawn and straightened but not on pointing, if pointing precedes head attachment in order of progression, and if carelessness in the pointing operation can result in bent shafts, determining the responsibility for the condition of the shafts at the head attachment stage may not be easy: Was the straightening defective or are the bent shafts due to careless handling by the pointer?

Inside Contracting because contractors have an incentive to suboptimize (shade quality) that is not operative among hourly employees.[18]

Inside Contracting and the Authority Relation have uniformly good assignment attributes. They have very different incentive properties, however. This is mainly because inside contractors have greater autonomy, appropriate the fruits of their own labors more fully, and need to be bribed to adapt cooperatively while employees working in an Authority Relation mode are less given to aggressive subgoal pursuit and do not resist adaptations because they do not possess the requisite property rights. Thus inside contractors work intensively and introduce local innovations, but respond to local or system adaptation requirements much less readily. Also since inside contractors do not own the equipment, malutilization may occur.

Specifically, the relevant time horizon to which inside contractors refer is the contract termination date. Repairs that generate benefits which more than recover costs within the contract interval will be made, but those for which the benefits can be recovered only if the contractor wins the bid for successive contracts will not.[19] Equipment repairs of a major kind will thus be deferred and left to the capitalist at the contract renewal interval. Even minor repairs may be postponed as contract termination dates approach.

(*b*) *Contracting comparisons*

Consider now table 2, where the same rankings are displayed — only here the modes are grouped by contracting attributes. The striking features of this table are: (1) continuous contracting modes have generally poor product flow attributes and uniformly poor local and system responsiveness attributes, (2) continuous contracting modes are uniformly good in station assignment, work intensity, and local innovation respects, (3) periodic contracting modes have generally good product flow attributes, and (4) although some periodic contracting modes are good in assignment and incentive respects, no general statements can be made for periodic contracting modes as a group in either of these general categories.

(*c*) *Aggregation*

Aggregation to obtain an overall efficiency rating for each mode requires that the relative importance of the eleven efficiency indicators be addressed.

[18]Piece rates for employees under the Authority Relation create worker incentives closer to that of Inside Contracting. More generally, piece rate workers have less incentive to act cooperatively than do hourly workers when adaptations are proposed. This type of limitation of piece rates has not received the attention it deserves.

[19]This assumes that inside contractors are compensated neither for repairs which yield benefits that extend beyond the contract termination date nor are they reimbursed for idle time if the capitalist were to make repairs during the contract interval. The former poses serious benefit estimation problems while compensating for idle time would set up incentives to utilize equipment carelessly.

Table 2

Simple efficiency properties at alternative modes, contracting grouping.

Mode	Product flow attributes			Assignment attributes			Incentive attributes				
	Transportation expense	Buffer inventories	Interface leakage	Station	Leadership	Contracting	Work intensity	Equipment utilization	Local responsiveness	Local innovation	System responsiveness
Continuous contracting modes											
Putting-Out	0	0	0	1	1	0	1	1	0	1	0
Federated	1	0	0	1	0	0	1	1	0	1	0
Inside Contracting	1	0	0	1	1	1	1	0	0	1	0
Periodic contracting modes											
Communal-emh	1	0	1	0	1	0	1	0	0	0	0
Peer Group	1	1	1	0	0	1	0	1	1	1	1
Authority Relation	1	1	1	1	1	1	0	1	1	0	1

This will obviously vary across industries. Suppose, however, that each is weighted equally and a composite rating is obtained by taking the row sum for each mode. The following rankings then emerge:

Mode	Row sum
Communal-emh	4
Putting-Out	5
Federated	5
Inside Contracting	6
Peer Group	8
Authority Relation	9

Even allowing for the fact that the rankings are very rough, several interesting relations warrant comment:

(1) The Communal-emh mode, which accords workers the greatest degree of job variety and appears to be greatly favored by Marglin,[20] is the least efficient mode. Although it is possible to ascribe the non-existence of the Communal-emh mode to pernicious efforts by vested interests to annihilate it, a more plausible explanation is that the Communal-emh mode is dragged down by its own efficiency disabilities.

(2) The least hierarchical modes, in both contracting and decision-making respects (see 2.3, above), have the worst efficiency properties. By contrast both the Peer Group and the Authority Relation rely extensively on a decision-making hierarchy — which indeed goes far to explain the superior performance of each. Hostility to hierarchy, thus, is evidently misguided. There may be more and less preferred types of hierarchy; but hierarchy itself is unavoidable unless efficiency sacrifices are made.

(3) The Communal-emh mode aside, periodic contracting modes have superior efficiency properties to continuous contracting modes.

(4) Modes are listed roughly in the same order as they appeared historically. Although it is possible to argue that later modes displaced earlier modes because the 'interests' were determined to stamp out autonomy, an alternative hypothesis is that successor modes have superior efficiency properties to predecessor modes. The progression from Putting-Out to Inside Contracting to the Authority Relation is especially noteworthy in this respect.

(5) Ranking the six modes in terms of power differentials between boss and workers is difficult for lack of a power metric. One nevertheless has the impression that there is a positive rank correlation between row sum efficiency and power. At the same time, this correlation seems to be less

[20]See his remarks quoted in section 2, supra.

than perfect. (Thus Putting-Out, which accords the boss greater power than does the Peer Group or Federated modes, has worse efficiency properties than both.) The best evidence that power is driving organizational outcomes would be a demonstration that less efficient modes that serve to concentrate power displace more efficient modes in which power is more evenly distributed.

5. Other considerations

The argument that successive modes of organization represent efficiency advances on earlier modes poses a dilemma for the New Left literature that was apparent even in Marx. I review some of these tensions here and go on to consider non-efficiency aspects of work, which features are emphasized by Bowles and Gintis.

5.1. Historical tensions

Early in his chapter on the division of labor and manufacture, Marx describes an organization where a capitalist employs a number of artificers. Initially each artificer, with the help of one or two apprentices, 'makes the entire commodity, and he consequently performs in succession all the operations necessary ... in his old handicraft way' [Marx (1967, p. 337)]. Except for workshop ownership, this appears to correspond with the Communal-emh mode of organization. This continues until external circumstances change. For example, an 'increased quantity of the article has perhaps to be delivered within a given time' [Marx (1967, p. 337)]. As a consequence of these changes, work is temporarily reorganized. 'Instead of each man being allowed to perform all the various operations in succession, these operations are changed into disconnected isolated ones, carried on side by side; each is assigned to a different artificer.... This accidental repartition gets repeated, develops advantages of its own, and gradually ossifies into a systematic division of labor' [Marx (1967, p. 337)]. The resulting division of labor thus appears to arise as an efficiency response to changing circumstances rather than as a capitalist scheme to divide and conquer.

Similarly, Braverman (1974, pp. 60–61) reports that the early phases of industrial capitalism 'were marked by a sustained effort on the part of the capitalist ... to buy labor in the same way we bought his raw materials.... This attempt took the form of a great variety of subcontracting and "Putting-Out" systems'. Braverman (1974, p. 63) then goes on to observe that the 'subcontracting and "Putting-Out" systems were plagued by problems of irregularity of production, loss of materials in transit and through embezzlement, slowness of manufacture, lack of uniformity and uncertainty of the quality of the product. But most of all, they were limited by their

inability to change the processes of production'. Unsurprisingly, these early forms of organization were supplanted by others that had better product flow, task assignment, and incentive attributes. Again, however, these changes are driven by efficiency; a pernicious scheme to divide and conquer is not needed to reach these results.

The principal historical study to which Bowles and Gintis refer is the paper by Stone, in which the transformation of the steel industry is examined. I think it useful to examine these matters from a transaction cost perspective.

According to Stone, the organization of the steel industry in the late nineteenth century corresponded approximately to the Inside Contracting system described and discussed above. The Amalgamated Association of Iron, Steel, and Tin Workers which was the union to which the skilled workers belonged and was reported to be the strongest union of its day, gave 'the skilled workers authority over every aspect of steel production' [Stone (1974, p. 64)]. The costly haggling and inflexibility to which Inside Contracting is subject predictably resulted. Operating inefficiency developed and innovations were suppressed. Examples cited by Stone (1974, pp. 64–65) include the following:

(1) The consent and approval of the executive committee within each department was needed to fill a vacant position.
(2) The details of the work were subject to recurring dispute.
(3) Output per worker was restricted.
(4) Production procedures were proscribed: '... the proportion of scrap that might be used in running a furnace was fixed; the quality of pig-iron was stated; the puddlers' use of brick and fire clay was forbidden, with exceptions; the labor of assistants was defined'.
(5) Presumably to perfect and maintain their monopoly over jobs, skilled workers were prohibited from teaching other workers.
(6) Changes in the physical plant could not be made without the approval of the executive committee of the union, which prevented the company from realizing greater labor productivity by reorganizing or mechanizing labor tasks.
(7) Innovations of a labor-saving kind were discouraged: 'The many innovations introduced between 1860 and 1890, of which the most notable was the Bessemer converter, increased the size and capacity of the furnaces and mills, but they generally did not replace men with machines'.

The resulting inefficiencies were apparent to the companies. Andrew Carnegie and Henry Clay Frick resolved to challenge the union at Carnegie's Homestead mill, which was reputed to be the strongest lodge of the

Amalgamated Association. A lockout was ordered in 1892, and Frick announced that the mill would thenceforth be operated non-union. Violence resulted, with members of the union pitted against scabs and Pinkerton agents. The support of state and federal governments helped Carnegie and Frick prevail. Whether emboldened by the success of Carnegie and Frick, or out of realization that their competitive viability rested on their being likewise able to disaffiliate with the Amalgamated Association, other steel companies challenged and beat the union as well. Association membership, which peaked at twenty-five thousand in 1892, was down to ten thousand in 1898. By 1910 the entire steel industry was non-union. The effects of the breaking of the power of the skilled workers are summarized by Stone (1974, p. 66) as follows: 'The decade that followed the Homestead defeat brought unprecedented developments in every stage of steel-making. The rate of innovation in steel has never been equaled. Electric trolleys, the pig casting machine, the Jones mixer, and mechanical ladle cars transformed the blast furnace. Electric traveling cranes in the Bessemer converter, and the Wellman charger in the open hearth did away with almost all the manual aspects of steel production proper. And electric cars and rising-and-falling tables made the rolling mills a continuous operation'.

Having broken the union's grip on procedures did not, however, assure the steel industry that its labor force would thereafter be organized efficiently. Such efficiency required that new institutional structures be devised. The objectives of the steps that were taken seem mainly to have been designed to (1) supply affirmative incentives for productivity, (2) tie the interests of the workers to the firm over the long term, (3) develop the requisite work skills among inexperienced workers, and (4) organize the work to preclude subsequent loss of control by the company. Although Stone interprets the various steps that were taken to realize these objectives as pernicious and evidence of a continuing class struggle between workers and employers, I would like to emphasize a different aspect: the incentive to challenge the union in the first place and the efforts to organize labor subsequently were principally geared to achieving efficiency, the rewards for which, once the new methods were imitated by rivals and rates of return were driven down to competitive levels, were diffused throughout society.

Also interesting is Stone's assertion that the above described benefits or reorganization could have been realized without the adverse oppressive effects of hierarchy. She contends that 'a system of job rotation, one in which the workers themselves allocated work, would have been just as rational and effective a way of organizing production' [Stone (1974, p. 66)]. While the details of such an organizational arrangement are not supplied, this rotation arrangement appears to correspond to the Communal-emh system[21]

[21]Possibly, however, Stone intends that a Peer Group with rotation arrangements be organized instead.

described in section 3 and evaluated above. That the Communal-emh mode has the worst efficiency properties of any of the six modes examined in this paper might be arguable. But that it is shot through with adverse incentives and maladaptive attributes is, I think, beyond dispute.

Consider finally the cooperative movement. Bowles and Gintis (1976, p. 62) observe that worker cooperatives, presumably Peer Groups, offered a viable alternative to the Authority Relation and 'were a widespread and influential part of the labor movement as early as the 1840s. ... The cooperative movement reached a peak shortly after the Civil War but failed because sufficient capital could not be raised'. They go on to quote Grob as follows [Bowles and Gintis (1976, p. 62)]:

> 'Even when funds were available the desire for profits often became so overwhelming that many cooperatives were turned into joint stock companies. Stockholders then became intent on paying low wages. Not unimportant were the discriminations practiced by competitors who feared the success of cooperative enterprises.'

While it is not possible in this paper to survey and explain the history of the cooperative movement, I submit that (1) worker cooperatives do approximate the radical ideal for work organization, (2) the repeated failure of worker cooperatives, despite their presumed attractiveness to workers and their apparent viability properties,[22] is a condition which demands explanation, and (3) the capital shortage hypothesis does not wash.

For one thing, workers who are attracted to cooperatives will presumably work for a lesser wage, since the oppressiveness of the Authority Relation is removed, and the greater profitability which thereby results should provide the necessary funds for such organizations to grow from retained earnings. Additionally, as the Grob cite discloses, the desire for profits rather than capital shortages was responsible for the demise of many successful cooperatives. Although this raises motivational issues of a troublesome kind,[23] presumably a decent respect for human nature as we know it ought to be reflected in any serious proposal for social reform.

[22]Note that the Peer Group comes off rather well in the composite efficiency rating of modes in section 4.2, supra. The Peer Group, however, experiences severe limitations as firm size is scaled up. See Williamson (1975, ch. 3).

[23]The apparent explanation for this transformation is avarice: the original members of the successful cooperative decided to appropriate rather than share the gains. I am uncertain how important this factor is in explaining the life cycle of cooperatives. One of the conditions, however, that radical economists appear loath to confront is what Knight (1965, p. 270). has referred to as 'human nature as we know it'. Organizing modes that are viable only among small communities of highly motivated members are scarcely interesting for purposes of organizing economic activity in society at large. Aspirations to improve the conditions of society are surely commendable. but how extensively human nature can be reshaped is uncertain.

5.2. *Job satisfaction/alienation*

One cannot read the literature of radical economists and the sociology of work without being impressed that work sometimes is oppressively organized and that efforts to remedy this are warranted. But much of this literature also suffers for want of reality testing. Thus when confronted with a conflict between what workers say in response to questionnaires and what they do in the marketplace, many social commentators place inordinate weight on questionnaires.[24] Most economists, by contrast, would argue that preferences are revealed by actual choices. Consider the following study of assembly line workers at a General Motors assembly line plant in Massachusetts reported by Etzioni (1975, pp. 34–35):

> 'An examination of their previous jobs indicates that by six criteria of job satisfaction, the workers were much better off on their previous job; 87.4 percent had formerly held a job where pace was determined individually; 72 percent had had nonrepetitive jobs; about 60 percent had had jobs requiring some skills and training; and 62.7 percent had been entirely or partly free to determine how their jobs ought to be done.... They chose to leave these jobs and take the frustrating assembly-line jobs basically because the new jobs offered a higher and more secure income. Three-quarters of the workers reported that the reasons bringing them to the new plant were primarily economic. Wage differences were about 30 percent — $1.51 per hour compared with $1.05.'

To be sure, better pay and better working conditions would be preferred by all. Confronted, however, with the need to make tradeoffs, valued attributes will be adjusted at the margin. Except as it can be demonstrated that work has been organized in an inferior manner, whence more satisfying work modes can be devised without sacrifice in efficiency, complaints about prevailing work practices, where workers have voluntarily sacrificed greater

[24]See, for example, *Work in America* (1973, p. 13). One gets a sense that when some observers do not get the answer they are looking for at the outset, questions will be reshaped and answers reinterpreted until the desired result is realized (*Work in America*, 1973, pp. 14–15). Innovative programs, such as Lincoln Electric's — which has a 40 year history of success — are reported (*Work in America*, 1973, pp. 107–108) without ever confronting such questions as whether Lincoln's employees are a random sample of the population or asking why Lincoln does not use this successful organizational innovation (or is not imitated by others) to diversify and become a large and decisive factor on the American business scene. Problems with 'conventional' modes, such as General Motors experienced at Lordstown (*Work in America*, 1973, pp. 19, 38), are reported as though these are windows in the future. If, however, as at Lordstown, these problems abate, attention is directed elsewhere. Likewise, whereas reorganizing the process for assembling automobiles at Volvo's Kalmar plant received widespread coverage at the outset, its subsequent history has been much less widely reported.

work satisfaction for greater pay, are of uncertain purpose.[25] Paul Blumberg, in a widely cited passage, contends that 'There is scarcely a study in the entire literature which fails to demonstrate that satisfaction is enhanced ... or productivity increases from a genuine increase in workers' decision-making power. Findings of such consistency, I submit, are rare in social research.... The participative worker is an involved worker' [cited in Bowles and Gintis (1976, pp. 79–80)]. Curiously, however, the evidence relating job satisfaction to productivity, discloses little or no association between the two [March and Simon (1958, pp. 48, 50), Vroom (1964, pp. 181–186), Katz and Kahn (1966, p. 373), Gallagher and Einhorn (1976, pp. 367, 371)]. Gallagher and Einhorn (1976, p. 373) conclude their survey of this literature with the observation that 'We feel that job enlargement and enrichment can be useful tools for management. However, the important question that remains is not whether these programs work, but rather, *under what conditions* will they be most effective' (emphasis added). And Gunzberg's recent survey of work mode changes in Sweden concludes that the economic consequences of participative practices have been difficult to assess. Thus although they have, in his judgment, yielded social/psychological gains, they 'do not add to the value of goods and services, and can add to their cost' [Gunzberg (1978, p. 45)].

Rarely, I submit, will optimum job design involve the elimination of hierarchy. Instead, it entails taking the rough edges off of hierarchy and affording those workers who desire it a greater degree of interested involvement. But it is no accident that hierarchy is ubiquitous within all organizations of any size. This holds not merely within the private-for-profit sector but among non-profits and government bureaus as well. It likewise holds across national boundaries and is independent of political systems. In short, inveighing against hierarchy is rhetoric; both the logic of efficiency and the historical evidence disclose that nonhierarchical modes are mainly of ephemeral duration.

6. Concluding remarks

The organization of work is, predominantly, a transaction cost issue. This does not mean that all of the interesting work mode issues can be evaluated in these terms, but most of them can. In particular, whether hierarchy has

[25]Inasmuch as automobile assembly is one of the more routinized of jobs, prior manufacturing employment for most automotive workers will, of necessity, rank more highly in job satisfaction respects. The basic point, however, is that composite evaluation of a job is a function of wages, job security, and job satisfaction. To focus only on the last is to ignore tradeoffs. The General Motors employees plainly did not accept inferior employment in job satisfaction respects without receiving compensating value in wage and job security terms. Although the adequacy of this compensation can be disputed on the grounds that the social valuation of job satisfaction exceeds the private valuation, this is a highly conjectural line of argument.

redeeming efficiency properties or is mainly to be understood in power terms can scarcely be assessed except as transaction cost issues are confronted. This needs to be done, moreover, in a comparative institutional way. Adopting such an approach entails:

(1) Ascertaining where trading is feasible and where it is not. This requires that tasks be described in sufficient microanalytic detail to disclose what parts of the task are technologically separable.
(2) Identifying alternative work modes and describing their operation in sufficient detail to permit their transaction cost properties to be assessed.
(3) Identifying the relevant set of performance dimensions with respect to which alternative modes are to be assessed.

This paper demonstrates that each of these steps can be implemented and that the piecemeal defects of prior studies (because interfaces were not identified, because mode comparisons were unnecessarily restricted, or because some of the relevant performance dimensions were omitted) can be avoided. Although I focus attention on a rather simple task — pinmaking — it is the obvious task to consider, given the history of the workmode literature. Indeed, failure to address pinmaking would certainly raise issues of non-comparability between my assessment and earlier studies.

The non-comparability of tasks ought not, however, to be exaggerated. The organization of any batch process manufacturing activity poses very similar transaction cost issues. Additionally, although technology may be either more (as with petroleum refining) or less (as with the organization of a legal office) determinative of work modes when other-than-batch process manufacturing is considered, the same microanalytic approach for evaluating work modes applies quite generally. This entails identifying the relevant transaction cost dimensions, describing alternative modes for organizing the transactions in question, and performing a comparative institutional assessment. Thus although both modes and transaction cost attributes will vary among activities, the same microanalytic and comparative institutional research strategy that is employed in this paper has broad applicability.

One of the striking results of this study is that ownership is only weakly related to hierarchy. This holds both in contractual and command hierarchy respects. Additionally, if simple aggregation is permitted, the modes that have the worst performance attributes are those which have the weakest hierarchical properties. The question of optimal work organization is thus poorly posed when it is put in terms of hierarchy or its absence. Attention ought to be shifted instead to whether reliance on hierarchy is excessive (generates adverse side effects) and whether appointments to hierarchical positions are made in a way that both promotes efficiency and commands general respect.

Thus whereas Marglin (1974, p. 33) poses the organization of work question as 'Is it possible for work to contribute positively to individual development in a complex society, or is alienating work the price that must be paid for material prosperity?', I would reformulate it instead as: Are there impediments which prevent the *requisite mix* of structures from appearing with the result that individuals who would be prepared to tradeoff material rewards for personal development denied the opportunity? A well-working system is one that matches work modes with job attributes and worker preferences in a discriminating way. In consideration of the transaction cost disabilities which non-hierarchical work modes commonly experience, choice of these will often entail a wage sacrifice.

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