Total Quality Control, Just-in-Time Management, and the Economics of the Firm

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Introduction

The set of principles grouped under the general headings of total quality control (TQC) and just-in-time (JIT) management are becoming increasingly important for intra-firm resource allocation, mainly because of competition from firms, initially and primarily Japanese, that have adopted such systems. For example, JIT production systems were found to be in use in 57 per cent of a sample of 132 British companies by Voss and Robinson (1987); Oliver and Wilkinson (1988) report that 64 per cent of companies sampled had adopted such production techniques. Apart from a few exceptions to be discussed later this increased importance does not seem to have been acknowledged by theoretical economists[1], even though, as will be argued below, TQC and JIT systems both illuminate and present problems for the economics of work organization and more generally the firm. This article presents an exploratory investigation of some of these implications. The discussion will be organized as follows: in the next section the set of principles that make up TQC and JIT will be outlined; this will be followed by a discussion of the Alchian and Demsetz (1972) rationale for the firm; the next section will concentrate on transaction cost economics and its perspective on the economics of work organization; the penultimate section draws the elements of the discussion together and discusses the nature of the firm in the light of TQC/JIT; finally some conclusions will be drawn.

Total Quality Control and Just-in-Time Management

Before discussing in detail the package of interrelated procedures which constitute TQC/JIT it will be useful to characterize the intra-firm resource allocation systems which were dominant pre-TQC/JIT. Sayer (1986) draws a distinction between just-in-time and, the earlier, just-in-case (JIC) systems. The following are important characteristic features of the latter:

(1) A central objective of manufacturing firms is high volume of standardized products as a means of exploiting unit costs advantages.

(2) Following from (1) machinery and intra-firm organization tend to be rigid and used to execute a single or narrow range of operations repeatedly.

The comments of two anonymous referees have significantly improved the arguments presented in this article. Obviously any remaining mistakes and confusions are the author's own responsibility.

Journal of Economic Studies, Vol. 20 No. 6, 1993, pp. 17-31 © MCB University Press, 0144-3585

(3) Because of high volume requirements and organizational rigidities large buffer stocks are an absolute requirement to avoid disruption; hence the just-in-case characterization.

JIC systems are those that, frequently and implicitly, underlie much microeconomic theory, a claim substantiated below, but a number of problems have become evident with their use (see Oliver, 1990; Sayer, 1986; Wilkinson and Oliver, 1989):

(1) Being geared to uniformity and standardization such systems can present only limited responses to market changes because of inbuilt inflexibilities.

(2) Intra-firm resource allocation requires expensive information and monitoring systems to avoid gluts and shortages. This problem obviously becomes more acute as the complexity of production increases.

(3) Large buffer stocks are expensive.

(4) Production and quality problems are concealed in buffer stocks. In addition the priority given to maintaining production levels precludes solving problems at source.

(5) Quality testing is more expensive than building quality into production. A separate quality control department increases overheads without increasing value-added.

(6) JIC systems require a rigid vertical hierarchy for co-ordination and control. This bureaucratization is counter productive in terms of both control, because of its unfeasibility, and motivation, because of resentment that heavy monitoring can cause.

(7) Finally, 1-6 inhibit the development of dynamic economies and learning effects.

The technical, factor and dynamic disadvantages implied by 1-7 are leading to a restructuring of intra-firm resource allocation systems because of competitive pressures from firms using TQC/JIT procedures. The latter are based on the following key principles:

(1) To respond to market changes, and to overcome product-line inflexibilities, emphasis is placed on the reduction of set-up times of machines. This increased flexibility partly offsets the loss of economies from long production runs (see Dosi, 1988). To achieve this, close relationships are necessary between different hierarchical levels within the firm, a central requirement of TQC. In addition, greater flexibility is sometimes achievable using smaller and/or simpler low technology machines rather than large highly sophisticated alternatives (Schonberger, 1982).

(2) Buffer stocks are undesirable for reasons stated above, therefore their progressive reduction towards zero is desirable. But smaller buffer stocks imply a greater visibility of errors and quality deficiencies, hence the centrality of TQC.

(3) TQC is based on the principle that quality is built into a product not inspected into it after production. Inspection deals with consequences not causes. The objective of building in quality, however, is contingent on two related factors: efficient worker-supervisor communications channels and self-motivated, co-operative and self-disciplined workers. These factors are necessary so that workers' tacit knowledge is communicable up the organisational hierarchy, with corresponding feedback, so that scheduling and improvements are possible; note, in this regard, the importance of procedures such as quality circles that offer workers greater responsibility for their work. In addition, a further necessary factor for TQC is that workers are trained to undertake regular preventative maintenance and immediate remedial action should problems arise. Relatedly, workers are trained in a wide range of activities to facilitate flexibility.

(4) An implication of (3) is that the ratio of indirect to direct labour will fall. For example, in electro-mechanical components manufacture this ratio in Japan is 1:2 compared with 3:2 in Britain; alternatively the ratio of quality control inspectors to direct workers in the West is 15 per cent, in Japan the figure is 5 per cent (Oliver, 1990).

(5) Production is not organized around maximum volume in anticipation of demand but rather work is done when needed. Output instructions are issued to the immediate upstream process detailing requirements that will be needed "just-in-time", this process is repeated at successive stages of production, both inside and outside the firm, so that buffer stocks are kept to a minimum. In short, production is pulled rather than pushed. To make this system feasible production planning must be highly effective and output must be smoothed to avoid anything other than minor fluctuations. Consequently, while internal factor and output mix substitution is increased under JIT/TQC systems, this is at the expense of short-run rigidities in overall production cycles.

(6) In more economic terms, the factors highlighted under (3) and (4) improve intra-firm flexibility in terms of factor substitution and output mix but at the same time human assets are made more specific, and less standardized. This, along with the short-run production rigidities mentioned in (5), means that substitution from outside the firm becomes more difficult.

TQC/JIT, Team Production and the Economics of Work Organization

Having outlined the basic principles of TQC/JIT the discussion will now develop possible implications for economic perspectives on the firm. This section will examine the work of Alchian and Demsetz (1972). Their approach is, of course, based on the existence of non-separabilities in production with the attendant difficulty of identifying individual productivities. Given such joint activity rewards are linked to team performance, which introduces a potential incentive problem for any one individual because the effects of reduced effort will be distributed throughout the team. Such shirking will result in general low productivity. Thus, so the argument goes, it will be in everyone's interests for a monitor to exist with the authority to exert penalties to prevent shirking.

Putterman (1984) suggests that the Alchian and Demsetz analysis is suspect in at least three areas: it ignores the psychic costs of monitoring; no reference is made to the inefficiencies of vertical relationships; and no comment is made about the improbability of detailed universal monitoring. It should be clear from the discussion presented in the previous section that Putterman's theoretical comments are given empirical support by the development of TQC/JIT.

The Alchian and Demsetz schema appears to be based on a conception of management pre-TQC/JIT. The principle of universal monitoring is consistent with narrow, rigid definitions of intra-firm responsibilities. But, as Oliver (1990) points out, the relevance of such systems is limited to situations of either limited complexity or high predictability, or using terminology more common within economics: when bounded rationality[2] does not impinge to any great extent on management activity. If management tasks are complex the inefficiencies of JIC systems will become obvious, or equivalently Putterman's criticisms of Alchian and Demsetz will be relevant. One option, according to Oliver, when organizational complexity is evident, is to increase the predictability of activities, but this is possible only when the market environment is stable. A second option is to reduce the complexity of processes by opting for TQC principles rather than universal monitoring. Such a strategy, based on self-motivation and obligation, functional flexibility rather than narrow task definition, and a reduction in the number of monitors, would be contingent on, if we follow the Alchian and Demsetz logic, a reduction in the significance of non-separabilities. The existence, or otherwise, of non-separabilities will be discussed in detail below, for the moment it is sufficient to point to the increased incidence of team-organized production with TQC techniques which would appear to imply that non-separabilities are evident.

It is clear, therefore, that the nature of the firm (in general) is not based on a necessity for universal monitoring. At most the Alchian and Demsetz schema appears to be a theory of a particular management style. Such a style reduces intra-firm resource allocation to a narrow conception of motivation. Positive motivation is viewed in terms of contractually specified rewards. More importantly, negative motivation, i.e. exerting penalties, is given a central place. Motivation procedures such as these are only technically efficient in uncomplex,

predictable conditions. More generally non-contractually-based positive motivation is a requirement of technical efficiency, with penalties being used as a last resort. But if such positive motivation is used to accommodate non-separabilities it follows that the nature of the firm cannot be reduced to a monitoring requirement, rather it must also include systems to promote constrained self-motivated behaviour.

It would appear, therefore, that there is no simple connection between team production and the nature of the firm. Non-separabilities, however, are still important, but in a different context. It is clear from Williamson's (1975, pp. 49-51) comments that *technological* interdependence can be separated by using buffer stocks, a method that is central in JIC systems as discussed earlier, with their attendant *organizational* inefficiencies. Consequently, if non-separabilities are to be a foundation stone for the nature of the firm (rather than a particular management style) it is at an organizational, rather than technical level that this must be located. Organization is necessary because of complexity and uncertainty (see Kay, 1984). Given such conditions organizational relationships facilitate the development of a body of idiosyncratic knowledge that can be effectively shared only by common experience within a firm (see Dietrich, 1990). Thus the existence of organization presupposes non-separability of its knowledge base, a point much the same as that made by Richardson (1972) when he emphasized the importance of the core skills of a firm as a factor delimiting its boundaries. In short, team activity and the nature of the firm are linked via the centrality of organization and bounded rationality not a requirement to monitor performance and exert penalties. Implications of this shift in perspective will be discussed below after examining transaction cost views on the firm.

TQC/JIT and Transaction Cost Economics

The discussion will now turn to consider the implications of TQC/JIT for transaction cost economics, and in particular the work of Oliver Williamson. General transaction cost reasoning is well-known: firms exist as a means of economising on transaction costs. More specifically, with regard to labour inputs it is more efficient to write general contracts with specific responsibilities being left to intra-firm management. The detailed nature of this management, however, and in particular the shift from JIC to TQC/JIT requires further analysis. Williamson (1985, Chapter 10) appears to incorporate the central features of this shift. He suggests a simple taxonomy based on two characteristics: the degree of human asset specificity owing to firm-specific skills, and the extent to which work relations are separable[3]. Four internal governance structures are identified:

(1) *Internal spot markets* are efficient when there are low degrees of asset-specificity and separable work relations:

> Neither workers nor firms have an efficiency interest in maintaining the association. Workers can move between employers without loss of productivity, and firms can

secure replacements without incurring start-up costs. No special governance structure is thus devised to sustain the relation. Instead, the employment relation is terminated when dissatisfaction by either party occurs (p. 245).

(2) *A primitive team* is appropriate with low degrees of asset specificity and non-separable work relations:

> This is the team organization to which Alchian and Demsetz refer (1972). Although the membership of such teams can be altered without loss of productivity, compensation cannot easily be determined on an individual basis. The simple brokerage rule described [for internal spot markets] is thus extended to include supervision (p. 246).

(3) *Obligational markets* should be used when there is considerable firm-specific learning but tasks are separable:

> Idiosyncratic technological experience . . . and idiosyncratic organizational experience . . . both contribute to asset specificity . . . [S]unk costs are incurred in qualifying a worker for productive employment in the firm. Both firm and workers have an interest in maintaining the continuity of such employment relations (p. 246).

(4) *A relational team* is relevant when human assets are specific and task non-separabilities are evident:

> The firm here will engage in considerable social conditioning to help assure that employees understand and are dedicated to the purposes of the firm, and employees will be provided with considerable job security, which gives them assurances against exploitation (p. 247).

The similarity between this last category and TQC/JIT systems is clear (subject to complications to be introduced below), and in addition Williamson (1985) draws the parallel between his relational team and characteristic Japanese forms of organization. Thus a shift away from a primitive team will occur with local, rather than hierarchical, management of non-separabilities, and the concomitant development of firm-specific skills.

A complementary analysis of this area is provided by Ouchi (1977; 1980). In the first of these works he argues that control systems must be based on observing and monitoring behaviour and/or output. The efficiency of behaviour control is contingent on a knowledge of the transformation process. On the other hand, with output control, knowledge of the transformation process is not required, but reliable and valid measures of the desired outputs must be available. This availability, or otherwise, of reliable output measures suggests a further element of organizational analysis: performance ambiguity. This along with goal congruence is used by Ouchi (1980) to develop the "clan" form of organization, which is equivalent to Williamson's relational team. A clan is more efficient than traditional bureaucratic structures because it not only facilitates goal congruence but also reduces the need for monitoring when performance ambiguity is high. The similarity between Ouchi's clan and TQC/JIT systems is clear.

While these analyses suggest useful insights into the economics of work organization, they are still based on a view of the firm grounded in JIC philosophy that stresses that "the employee stands ready to accept authority regarding work assignments provided only that the behaviour called for falls

within the 'zone of acceptance' of the contract" (Williamson, 1985, p. 218). Furthermore, "explicit and implicit understandings regarding the zone of acceptance of the employment relation . . . need to be reached. Once agreement has been reached . . . boss and worker essentially agree to "tell and be told" (pp. 220-21). It is clear that motivation is narrowly based on contractual commitment. But the innovation of TQC/JIT procedures suggests that a shift in this framework is required. In particular, investment in participatory management systems is an important means of generating self-motivated behaviour that meshes into overall corporate policies. It is necessary not only for individuals to respond to economic (dis)advantages but also for preferences to be moulded and developed to induce people to behave in particular ways. Thus Strong and Waterson (1987, pp. 39-40) suggest that:

> lower-level workers need to be given the correct incentives to use local information optimally (from the firm's viewpoint) in decision making and, if necessary, to report information truthfully to superiors. One means of benefiting from the superior local information of subordinates is to encourage participation in setting standards for work tasks.

Involvement of the sort that Strong and Waterson highlight is central to the management techniques discussed earlier. Oliver (1990) makes the following comments about employee motivation and TQC systems:

> . . . if one is to avoid direct control which is both costly (and inadequate) then perhaps a sense of responsibility, obligation or commitment to make sure that a good quality product is produced can serve as a substitute control mechanism. . . . Unlike the approach which typically assumes that a change in attitude must precede a change in behaviour, this view [of commitment] regards behaviour as governed largely by the social context within which people are operating. Changes in behaviour, under this model, stem from adjustments to the context rather than from adjustments to attitudes (pp. 23-4).

In addition:

> If the [TQC] arrangements . . . set up the conditions for social control and commitment then arguably it is systems of employee involvement which function to provide the direction of the commitment or legitimation of the standards and targets in use (p. 28).

Investment in the development of non-contractual positive incentive mechanisms will result in less direct expenditure being necessary on the structuring, administering, and enforcing of contracts. A clear indication of this is the reduction in the ratio of indirect to direct labour reported above. In short there are organizational or incentive-based economies which can be exploited by managing intra-firm relationships through the development of positive incentive mechanisms associated with TQC/JIT systems.

The importance of investment in participatory management systems can be introduced into a transaction cost framework in ways suggested by Dow (1987). He accepts Williamson's (1975) view that employee idiosyncratic knowledge introduces the possibility of opportunistic behaviour, but rejects the conclusion that a rigid management hierarchy within a firm is therefore necessary for efficient resource allocation. Dow makes the point that opportunistic behaviour by senior management is possible given information asymmetries within the corporate hierarchy, hence participative management systems are useful to

overcome potential abuse of authority. TQC/JIT systems appear to offer support to Dow's argument,

Williamson (1985), of course, rejects the necessity of participative organizations. He cites "evidence relating *job satisfaction* to productivity [which] discloses little or no association between the two" (p. 270, emphasis added). Clearly job satisfaction is not the same as employee involvement in decision making. Williamson goes on to cite Gallagher and Einhorn (1976, p. 373): "we feel that job enlargement and enrichment can be useful tools of 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 by Williamson). It is perhaps pertinent to suggest that job satisfaction schemes which are introduced into an otherwise bureaucratic hierarchy, what was called earlier the JIC model, will have little or no effect, but using TQC procedures – employee participation, and job satisfaction, is essential.

Underlying these differences of opinion about the relative advantages of participatory management are more fundamental theoretical issues to do with the nature of the firm. Leibenstein (1987) suggests that intra-firm behaviour can be analysed in game theoretic terms with resulting co-operative and non-co-operative equilibria. The former, based on the development of trust rather than narrowly defined individual interest, is Leibenstein's characterization of the Japanese firm with its superior efficiency levels, we can link similar reasoning to TQC/JIT systems. Simon (1991) stresses an equivalent point when he argues that effective organization depends on initiative rather than simply obedience, but this is developed not simply by economic rewards but most importantly by organizational identification facilitating the growth of pride and loyalty.

If these arguments are accepted it follows that the "zone of acceptance" in an employment relationship, as discussed above, is endogenous to organizational practices. This endogeneity presents problems for transaction cost economics. To understand why this is so we can characterize the Williamsonian view of the firm in the following terms (see Dietrich, 1993). Pre-given technologically separable units are assumed to exist. When these units undertake exchange transaction costs are incurred. It follows that the most efficient, in contracting terms, set of governance structures is that which minimizes the transaction costs involved. But if the zone of acceptance of the employment relationship is endogenous with respect to different organizational configurations it follows that the characteristics or nature of units under consideration is not pre-given but rather changes with different governance structures. In economic terms the production cost and revenue potential will be endogenous and shift with different organizational configurations. To differentiate these latter effects from transaction costs, which assume organizational characteristics are unchanged with different governance structures, they can be called the benefits of resource allocation (Dietrich, 1991).

We can now understand the way in which the development of TQC/JIT presents problems for transaction cost perspectives on the firm. To restrict

attention to the costs of allocating resources the characteristics of economic units, i.e. production cost and revenue potential, must be assumed exogenous. It is for this reason that Williamson can claim that senior management decisions are in some fundamental sense rational and not subject to their own opportunism because they can be viewed as an optimization problem given market and technological constraints. This is revealed most clearly by Williamson's (1975) claim that the shift from U- to M-form organizational structures allows the firm to be analysed in neo-classical profit maximizing terms. The introduction of TQC/JIT makes clear, however, that organizational form does not simply respond to transaction costs but important dynamic gains are evident, in terms of technological and product-market advantages, that change the characteristics of productive activities. In short, decisions to first internalize economic activity and second adopt particular intra-firm configurations involve governance structure benefits as well as costs.

In general terms the benefits of particular governance structures can be summarized under two headings (see Dietrich, 1993): monopoly power and idiosyncratic advantage. With regard to the first of these the analyses of Marglin (1974; 1982) are relevant. He suggests that the evolution of organizational form has responded to the greater control required by capitalists/senior management to transfer a latent surplus to centralized use. This greater power is derived from a monopoly over knowledge of production activities. TQC/JIT is relevant here because it shows that barriers to senior management control exist in terms of motivating employees, a matter discussed further below.

With respect to organizational idiosyncratic advantage the introduction of TQC/JIT is one aspect of a general trend in recent managerial thinking. For example, Prahalad and Hamel (1990) and Pettigrew and Whipp (1991) stress the importance of "core competence" and "idiosyncratic organisational assets" respectively to the achievement of corporate success. In common with TQC/JIT, stress is placed on achieving dynamic advantage rather than economizing with given constraints. One implication of this, emphasized earlier, is that the nature of labour substitution changes. The development of idiosyncratic skills implies a reduction in external substitution possibilities but an increase in functional flexibility; this has a fundamental implication for our understanding of the firm which will now be discussed.

The development of intangible organizational assets associated with TQC/JIT, and the efficiency-flexibility gains that result, changes the cost structure of a firm. Intangible assets are fixed rather than variable. Relatedly, intra-firm flexibility implies limited extra-organizational substitution, as discussed earlier. A consequence of these changes is that organizational capacity use must be high to guarantee low unit organizational costs. It follows that any uncertainties that may compromise the logic of a high use strategy will be removed from the core of the organization. Thus, the resolution of modern management problems results in the "flexible firm" (see Pollert, 1988) in which the primary, or core, group of employees is organized on the basis of self-

motivation towards corporate objectives. Coexistent with this is peripheral organization, which is based on, for example, short-term contracts and subcontracting. The latter groups are more able to absorb uncertainties because traditional hierarchical management principles do not have the cost implications just discussed and they facilitate extra-organizational substitution, as discussed earlier[4].

A number of implications would appear to follow from this core-periphery model. The shift in management styles and work organization characterized by TQC/JIT is unlikely to be universal. Thus peripheral organizations, which are in effect examples of Williamson's internal spot market and primitive team, have their existence based on attempts by core firms to increase static efficiency. In terms of a Marglin-type explanation, subcontracting and similar practices can be viewed as attempts by core senior management to increase control over profit potential. It follows that the absence of firm-specific learning in peripheral activities is a strategic decision rather than an exogenous constraint. The form of work organization is, therefore, to some extent dependent on the decisions of firms that involve a trade-off between static and dynamic gains and the required organizational form.

TQC/JIT and the Nature of the Firm

Discussion in the previous two sections has indicated that the development of TQC/JIT implies a number of problems for the way the firm is conceptualized by economists. The Alchian and Demsetz view was seen to be an analysis of a particular management style rather than a general theory. But, it was argued, team production is important at an organizational rather than technological level. In terms of transaction cost economics, only a partial analysis is possible because of the way unchanged organisational characteristics are assumed when governance structures are analysed – this ignores centrally important dynamic benefits of TQC/JIT.

These limitations of the standard analyses of the firm can to some extent be reduced to a common factor that the firm is viewed as a simple hierarchy with, to use a Penrosian (1980) term, a single "subjective productive opportunity" determined by senior management. Such a view may be an accurate description if JIC intra-firm systems are used, or to use the Williamsonian formulation introduced above: boss and worker agree to tell and be told. But the development of TQC/JIT compromises this view because senior management activity involves not only line responsibilities and the development of control procedures but also the meshing together of sub-unit initiatives. This is a conception of management that encourages and expects responsibility and proactive behaviour from lower-level organizational units (Drucker, 1988). An implication of this shift is that a firm's productive opportunity is no longer identified with a single strategic orientation but rather it is a strategic framework within which sub-unit opportunities are developed. Of course, the management of any capitalist firm has its economic aspects based on line responsibility and centrally organized control procedures. Hence autonomy

becomes increasingly constrained at lower hierarchical levels, and proactivity is increasingly enabled at higher levels.

This formulation of the nature of the firm as a strategic framework, rather than a strategic orientation, is consistent with recent work by Gillies and Ietto-Gillies (1991) on the use of probability in economics. They suggest that probability can be defined not only in an individual or subjective way, but in addition intersubjective probabilities can be applied to social groups. For the latter to be possible two conditions must hold: that members of the group be linked by a common purpose; and that there must be a flow of information between members of a group, no matter how this flow is organized. It follows that a relevant strategic framework that channels lower level proactive behaviour can be defined in terms of the existence of intersubjective probabilities[5]. In terms of the earlier analysis of the Alchian and Demsetz (1972) view of the firm the existence of intersubjective probabilities is an alternative way of defining the non-separable knowledge base of an organization.

Two important implications follow from this definition of the firm as a strategic framework. Intra-firm diversity will exist in all but the smallest of firms. It follows that even when JIC systems are used diversity will exist, even though it is denied by organizational practice: some activity will always be beyond the control of managerial decision making. In JIC-dominated firms these lower level choices will be directed by autonomously defined aspirations and appear as an indicator of dysfunctional activity. For this reason Simon (1965) suggests that the circumventing of formal procedures may be a sign of inefficiency. But as Brooke and Remmers (1970) have pointed out, informal relationships can be recognized and developed to further organizational objectives, a central feature of TQC/JIT systems.

The second implication that follows from defining the firm as a strategic framework is that it allows for the possible divergence of economic and legal definitions of the firm. The development of subcontracting and similar practices, which was seen earlier to be related to TQC/JIT systems in core firms, extends the strategic framework beyond its legal boundaries if the productive opportunities of peripheral activities are effectively locked into the core. Such lock-in can be understood in terms of the existence of intersubjective probabilities. It follows that economic activity cannot be understood in terms of a simple markets-hierarchies framework. The economic content of decisions suggests that hierarchical resource allocation can extend beyond the legal boundaries of the firm.

Conclusion

This article has suggested that the development of TQC/JIT intra-firm resource allocation systems both illuminates and presents problems for economic analyses of the firm. In terms of an Alchian and Demsetz type perspective, it has been argued that non-separabilities are of central importance to the firm but they operate at an organizational, rather than technological, level.

Furthermore, such organizational team activity can be understood in terms of the existence of intersubjective probabilities. Transaction cost analyses of work organization appear to offer a coherent analysis of TQC/JIT, but they are highly partial because of failure to accommodate important dynamic benefits of resource allocation. Recognition of these latter effects allows control over resource allocation to be introduced into the analysis in its own right rather than as a by-product of transaction cost economizing. Related to this is the importance of participative management for TQC/JIT systems which facilitates the promotion of positive motivation and the constraining of possible senior management opportunism.

While the implications of TQC/JIT have been developed, in this article, in terms of the organization and nature of the firm, the critique offered has more general application. It would be inappropriate to develop these general implications in any detail, which would require a work in its own right, but a few indicative comments may be pertinent in this conclusion. The perspective on the firm suggested here shifts the conceptualization of the firm away from a single, subjective productive opportunity with its implied single strategic orientation. As an alternative, it has been suggested that the firm should be viewed as a strategic framework that constrains and directs lower level proactive behaviour An implication of this shift is that our conceptualization of the entrepreneur, or entrepreneurial behaviour, is similarly limited; a critique that applies to both Austrian and Schumpeterian perspectives. The former, as suggested by Kirzner (1973), stresses the equilibriating role of the entrepreneur perceiving and organizing resources to meet unmet consumer need. The Schumpeterian (1936) view stresses the disequilibrating role of "creative destruction". Either perspective limits proactive behaviour to an organizational leader. But if the firm is viewed as a strategic framework the entrepreneur need no longer be an individual, rather entrepreneurial behaviour (at least in core firms) will be embedded in organizational routines (to use the Nelson and Winter (1982) term).

Once the analytical shift suggested here is accepted, further implications follow. Take, for example, the case of industrial policy. If this is used to stimulate economic change it is no longer sufficient to simply "level the playing field" and rely on Austrian or Schumpeterian entrepreneurs. Rather, with embedded entrepreneurship industrial policy can rightly orient itself to intra-organizational activity and, in turn, the wider institutional determinants of organizational functioning (Dietrich, 1992). It follows that Earl's (1990) conclusion, based on surveying the psychological literature, that entrepreneurial traits, such as creativity and attempting to control one's life, can be developed in a non-centralized society which encourages divergent and open-minded thinking, is equally relevant to the economics of the firm. In short, the development of TQC/JIT suggests moving beyond a mechanistic organizational economics, which once accepted has fairly radical implications for the analysis of resource allocation.

Notes

1. This claim of non-recognition by economists is substantiated by the fact that the *Journal of Economic Literature* database contained no relevant entries under the headings of "total quality management" and "quality management". Aoki (1988; 1990) and Leibenstein (1987) are exceptions, also Carmichael and MacLeod (1993) is relevant. Radical theorists appear to be more aware of the significance of these developments; see for example Sayer (1986) and Tomaney (1990). The management literature is, of course, the source of TQC theory; see, for example, Cullen and Hollingum (1987), Feigenbaum (1983) and Ishikawa (1984); on JIT systems see, for example, Schonberger (1982).
2. Bounded rationality is based on the idea that individuals, or collectives of individuals, inevitably have:
   - incomplete information, i.e. uncertainty exists; and
   - bounds on their ability to process information, i.e. the world is complex; see Simon (1986).
3. Williamson's (1975) criticisms of the Alchian and Demsetz view of the firm, as cited in the text, are also present in his 1985 work: "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" (p. 213). This appears to be inconsistent, in the absence of any discussion indicating otherwise, with the use of an Alchian and Demsetz framework in the same book.
4. Using a different formulation Aoki (1990) comes to a similar conclusion to that drawn in the text. He claims that "to protect the interests of incumbent employees . . . [a Japanese core] firm tends to limit the expansion of the work force relative to the growth of value-added by spinning off relatively labor-intensive activities . . ." (p. 21). The development and financing of overhead human and intangible organizational assets obviously requires a relatively high accounting contribution, or mark-up over marginal costs. With regard to Britain it is interesting to note Pollert's (1988) comment that there appears to be no clear strategic shift towards flexibilization. Perhaps this is an indication that British management is failing to keep up with the state of the art in its discipline.
5. It should be emphasized, however, that Gillies and Ietto-Gillies (1991) define probabilities in an epistemological rather than objective sense. This means that they are not properties of the external world but are based on a degree of knowledge or belief. This distinction is important because it implies that constraints on decisions do not render individual and group decision making deterministic. The fundamentals of human agency are unchanged and involve choice and creativity that are bounded by and interact with constraints (Hodgson, 1988).

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