Industrial Relations and Technical Change:
The Case for an Extended Perspective

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March 1987
ISSN Nr. 0722-673X
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ZUSAMMENFASSUNG

In der liberal-pluralistischen Tradition wird das Verhältnis zwischen industriellen Beziehungen und technischem Wandel als Reaktion eines halb-autonomen institutionellen Subsystems auf eine "technische Umwelt" aufgefaßt, die es selbst nicht beeinflussen kann. Das vorliegende Papier vertritt die These, daß zum Verständnis zentraler gegenwärtiger Entwicklungen die Schranken dieses Ansatzes überschritten werden müssen. Es zeigt zunächst, wie technischer Wandel die Organisation der Arbeit und die Definition und Hervorbringung von Qualifikationen nicht nur beeinflußt, sondern selber von ihnen beeinflußt wird. Danach wird dargestellt, wie durch diese Faktoren vermittelt technischer Wandel auch mit kommerziellen Unternehmensstrategien und "Fertigungspolitiken" zusammenhängt, die nach dem Grad unterschieden werden können, zu dem sie sich entweder auf "economies of scale" oder auf "economies of scope" stützen. Im Anschluß hieran werden die Beziehungen zwischen Fertigungspolitiken und Produktmärkten diskutiert, wobei auf die derzeitige Renaissance der Facharbeit und die Herausbildung einer neuen Form von "diversifizierter Qualitätsproduktion" hingewiesen wird. Insbesondere die letztere, so wird argumentiert, bedingt eine zunehmende Wichtigkeit qualifizierter Arbeit, da sie hohe "Flexibilität" der Arbeitsorganisation verlangt. Dies wiederum steigert die funktionale Bedeutung der industriellen Beziehungen ungenacht dessen, daß die gleiche Entwicklung deren institutionelle Autonomie untergräbt. Die gegenwärtige Konfiguration enthält damit die Möglichkeit einer Neubelebung älterer, radikaler Konzeptionen einer arbeitsorientierten "Produktpolitik", deren Radikalismus jedoch durch die neuartige funktionale Verbindung zwischen industriellen Beziehungen und der Entwicklung der Produktmärkte entschärft wird.

ABSTRACT

In the liberal-pluralist perspective on the connection between industrial relations and technical change, the former is conceived in terms of a semi-autonomous institutional subsystem which reacts to changes in its "technological environment" rather than playing a part in fashioning them. The paper suggests that in order to understand important present developments, it is necessary to go beyond the limits of this approach. It shows, first, how technical change not only influence but also depends on the way in which work is organized and skills are generated and defined. Mediated through these factors, technical change is also conditioned by commercial strategies and manufacturing policies that can be distinguished by the degree to which they are founded on either "economies of scale" or "economies of scope". Next, the paper discusses the links between manufacturing policies and product market developments, pointing to the currently visible reemergence of "craft production" and a new type of "diversified quality production". Especially the latter is argued to imply greater importance of skilled work as it requires high "flexibility" of work organization. This, in turn, increases the functional importance of industrial relations while at the same time undermining its institutional autonomy. The present configuration offers an opportunity to revive older, radical concepts of a labour-oriented "product policy" whose radicalism is, however, defused by the new functional link between industrial relations and product market developments.
1. Introduction

The relationship between technical change and industrial relations has for too long been analyzed in a deterministic, uni-directional and a-historical framework, in separation from the wider institutional and economic context in which it is embedded. This, we maintain, reflects a tendency of mainstream industrial relations theory to take the historically contingent institutional arrangement of a differentiated, specialized "industrial relations system" as its unquestioned basis of concept formation and theory building. As a consequence, the relationship between technical change and industrial relations came to be primarily viewed from the perspective of worker and trade union "resistance to change", and the explicit or implicit analytical objective became to compare and evaluate different industrial relations institutions by the extent to which they either permitted technical change (the "liberal" wing of the discipline) or prevented it (the "radical" position).

Our central criticism of the traditional approach to the relationship between industrial relations and technical change is that it treats the latter as an exogeneous factor that operates on the former from the outside - the "inside" being essentially conceived in terms of a semi-autonomous social subsystem in the pluralist-functionalist mould (Dunlop 1958; Kerr et al. 1960). As a result, the direction and substance of technical change appear to be independent of the social institutions that regulate the exchange between capital and labour. Industrial relations, both in theory and in practice, becomes limited to the implementation of (managerial strategies of) technical change and appears to have nothing to do with its conception. Radical critics have seen this as reflecting, and in fact reinforcing, the

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A first version of this paper was presented at a German-Japanese workshop, "Coping with New Technology in Japan and the Federal Republic of Germany", in Berlin, August 1986. We are grateful to the participants and to a number of colleagues at the Wissenschaftszentrum Berlin for detailed and constructive criticism.
exclusion of labour in capitalist societies from important industrial decisions, such as those on technology. But this overlooks the fact that trade unions themselves have often been quite content limiting themselves to negotiating with industrial relations managers on wages and conditions, and dealing with technology only insofar as it affects the latter. It also overlooks the possibility that while technical change may not be a direct subject of industrial relations, it may nevertheless be influenced by it, and while such influence may be indirect and latent, it may nevertheless be important.

To assess fully the mutual relationship between industrial relations and technical change, it is necessary to extend the scope of the inquiry beyond the historically contingent configuration of differentiated institutions of joint regulation that emerged in the post-war period and that has come to be equated with industrial relations (Batstone et al. 1984, 5). One possible gain may be an improved capacity of industrial relations actors, and trade unions in particular, to take the impact of their behaviour on technical change into account. Moreover, by making strategic use of hitherto latent lines of causation trade unions may be able to extend their range of activities and objectives beyond the narrow limitations placed on them in the pluralist-functionalist model. In fact, we believe that doing precisely this will become increasingly essential for trade unions at a time in which the relative sovereignty and autonomy of the traditional industrial relations system are being progressively eroded under the impact of rapid economic, organizational and political change.

This paper will look in particular at two clusters of contextual variables that affect technical change and industrial relations both separately and in their mutual interaction. One describes what we call the organization of work and skills, the other, the market and product strategy selected by a given firm or industry. In the following sections, we will first look at technical change and discuss the way in which it is linked to the two clusters of variables (Parts 2. and 3.). Next (Part 4.), industrial relations will be introduced and
analyzed in its relationship to technical change as mediated through the organization of work on the one hand and the strategic selection of markets and product ranges on the other. In the Conclusion (Part 5.), we will try to draw out a number of possible consequences of our argument for industrial relations and trade unions in the present period of economic and institutional restructuring.

2. Technical Change and the Organization of Work and Skills

By "organisation of work and work skills" we mean an array of variables that are salient for industrial sociology, the labour process debate and the sociology of management and organization. They include:

- the degree to which "execution" or direct production is separated from planning, engineering and maintenance (the functional division, or specialization, of labour);

- the extent to which management and supervisory functions are differentiated from indirect and direct production (the hierarchical division of labour);

- the concentration of knowledge, expertise and specialized experience in certain positions and functions (planning, engineering, design, development, management), accompanied by the "deskilling" of direct production or subordinate jobs, which has also become known as the "polarization of skills",

- the numerical growth of organizational sub-units in management, engineering and planning,

- the degree of rigidity which is inherent in the forms of division of labour mentioned above.

These variables can be divided into qualificational factors, or skills, and organizational factors which refer to characteristics of
workflow organization or organization structure. We use the word "qualification" in the "Continental" sense, i.e. denoting the skills and knowledge embedded in a person or required for the achievement of a work task, whereas often in English usage, "qualification" refers to paper qualifications, diplomas or other more formal sources of proof that are more or less tenuously connected with a work role or personal knowledge and experience.

Our second block of variables is "technology" or "technical change". There have been numerous studies about examples of technical change, and it has been attempted to provide standard definitions of a variable purporting to represent "technology". But research experience has shown that standard operational definitions of such concepts are hard to obtain (see for instance Woodward 1970). The concept of technical change has been developed largely in the context of the automation discussion; an earlier survey, for example, was entitled "Technology, Technical Change and Automation" (Parker et al. 1972, Chapter 9). Yet, it has been shown that we are not in fact dealing with a homogeneous phenomenon, i.e. highly correlated dimensions. Even at a fairly high level of standardization of variables, Child and Mansfield (1972) have demonstrated that a "technology scale" ought to be differentiated into separate measures of production continuity and workflow integration which "are conceptually distinct and in both studies they only shared about 25 percent of variance in common..." (1972, 376).

A further complication is that technical change cannot be simply considered as consisting of variation along a known and well-defined dimension. Whereas in the classic Blau and Schoenherr (1971) study, the degree of automation was measured by the existence or non-existence of a central computer in a labour agency, any such operational definition has become meaningless by now. New technology raises the need for new standard definitions of technical variables, making previous standard definitions obsolete as innovation occurs.
At present, the notion of technical change is largely connected with the application of microelectronics in products and processes. But arguably, the consequences of process applications need not be the same as those of product applications, and they may not be homogeneous in themselves. This paper explores the consequences of process applications of microelectronics, i.e. in the form of measurement and control engineering, communication and information technology equipment. Paradoxically, changes in process engineering seem to be more conveniently related to changes in product markets than changes in product technology. While our argument focuses on process applications of microelectronics within the manufacturing industries, it may be possible to extend it to cover services. We also expect a more valid and refined argument from such a transfer, but we are not able to achieve it at this stage.

Process applications of microelectronics—i.e. CNC machines, CAD/CAM equipment, industrial robots, computer-aided engineering (CAE) and computer-aided production control (Gunn 1982)—are today in the limelight of industrial sociology and organization and management research. The procedure has, more or less, been to neglect the question of how to fit technical change into a standard scale. Researchers have selected particular cases of technology or technical innovation for study, and general conclusions have then been drawn by aggregating and discussing findings from individual cases (Manpower Services Commission 1985; Braun and Senker 1982; Gensior 1986).

In the sociological tradition the interaction between the organization of work, the generation and distribution of skills, and technical change has mainly been conceptualized using the notion of the social division of labour. After Durkheim (1964), the key trend identified for societal development and technical change has been an increasing division of labour. In industrial sociology, this trend has been interpreted in basically three different ways:

The first view may be called the degradation of work or polarization of skills approach. It was exemplified by Braverman (1974) and Kern
and Schumann (1970) and held that in capitalist production, complex work roles are continuously broken up and divided into, on the one hand, lower grade, more routine, simple and monotonous roles within a more segmented organization of workflow, and more demanding, responsible and varied roles founded on more elaborate education and training on the other. Leaving aside a few conceptual controversies and empirically deviant cases - which, one might suggest, can always be found with respect to highly general propositions - this approach has proven highly pertinent through a long time of the post-war economic boom period and across many studies (Parker et al. 1972, 118-119; Sorge 1979). On the other hand, it has also been apparent that the low-grade skills which emerged at the bottom of the industrial and services workforce hierarchies were particularly exposed to rationalization measures through technical and organizational change. The result in a long-term perspective may thus have been a numerical decline of degraded places of work.

This perspective thus shades into another one which may be called decline-and-rise of skills. This has held that after the degradation process, the evolution of work roles was in the direction of upgrading and enrichment. This reversal of the previous trend was seen to be due to the increasing prevalence of continuous-process production after the heyday of mass production had come to pass. We have put the idea into terms defined by Woodward (1965), and she had used her typology as an evolutionary scheme, too, but the evolutionary concept dates back to such authors as Friedmann (1950) and Blauner (1964).

Whichever interpretation was adopted, scholars have for a long time searched for a deterministic view of technical change and work that was able to explain a host of diverse incidents of change by referring to a universal long-range tendency. At the same time, there has always been an approach which stressed the importance of socio-technical choice. It has notably been founded on research in the Tavistock Institute, and it has asserted that the evolution of work was in no way determined by the course of technical change but by the rationale or strategy adopted by leading decision-makers in an organi-
According to this view, the optimal development of the technical, the social and the "sentient" systems of an organization was founded on a strategy of enriching skills and achieving an overlapping, rather than divisive, organization of work tasks.

With research on applications of microelectronics, the last view has gained increasing ground (see for example, Sorge et al. 1983; Kern and Schumann 1984; Trist 1981). Proponents of the polarization of skills thesis often turned to a perspective admitting greater choice between alternatives than they did before. It was also often suggested that enrichment of skills was a consequence of "new technology". We would view this latter interpretation as an unfortunate variant of the original argument as it seems to maintain the technical determinism inherited from earlier research and public discussion. Our view is that there is, and has always been, some amount of choice. It may also be that the cost-and-benefit calculations of choices have increasingly been loaded towards a more "organic" (Burns and Stalker 1961) organization with more enriched skills and overlapping work roles, which is in fact compatible with increased "division of labour" in the sense of an increase in the number of specialized occupations. But it may be that work roles at the bottom are less fragmented and the division of labour features a greater amount of overlap of tasks and skills. In this respect, it is conceptually most important to distinguish the extent and the mode of the division of labour. The first may be represented by the number of different specialisms (jobs, work roles, occupations) whereas the second is defined by the rigidity with which specialisms are separated - or, conversely, by the amount of overlap between differentiated sets of activities and skill and knowledge profiles. "Organic" organization should be defined on the basis of overlap rather than number of specialisms.

This distinction is particularly applicable in view of long-term as opposed to short-term changes. It is, of course, true that socio-technical choice always comprises functional equivalents, of less divided and specialized ("craft") organization on the one hand and
more divisive and specialized ("bureaucratic") organization on the other (Stinchcombe 1959). Such choice exists at any given moment. But these equivalents not only exclude each other; they are also to some extent compatible (Heydebrand 1973). In the evolution of work and technology over time, the alternative to increasing specialization may not usefully be construed as decreasing specialization, i.e. as "craft" instead of specialization. In the long run, the more promising alternative seems to be specialization with a greater "craft" element. This does imply a broadening range of specialisms; however, these are less rigidly separated but linked through organizational overlap, training or career trajectories.

Looking at the rationale of alternative strategies of organization and skilling, the advantages of a polarizing regime lie in the economics of scale arising from the production of larger batches for larger and increasingly homogeneous markets, uniform mass markets in the extreme case. In such a regime, it pays to concentrate and develop separately a wide range of engineering, planning and preparatory tasks. This makes for a more rigid division of labour including "degradation" of direct work. This logic, which has economic and organizational angles, was clearly articulated by Thompson (1967, 72-73), to quote a classic author in organization theories. Mass markets which are both homogeneous and stable breed a concentration of functions and more rigid bureaucracy.

The opposite situation exists in a heterogeneous and shifting market. A company may be seen to match such a market context with its own technical and organizational infrastructure in mainly two different ways:

- It may scrap "old" equipment and units and build up or add "new" ones, dedicated to new product lines within a more diversified and innovated product range.

- It may also expand or diversify its product range by making its technical and organizational apparatus more flexible, without in-
creasing the specialization and dedication of production lines or plants with regard to specific segments of the product range.

The two ways differ in their implications for the technical and organizational infrastructure. The first strategy represents a "classical" diversification and innovation by way of new, separable and fairly self-contained plants. Under the second strategy, the flexibility of one or more integrated plants is increased so that the dedication or product specificity of equipment and organizational units is reduced. The first strategy is well known but less pertinent to the emergence of more differentiated product markets. It is more apt to cope with newly emerging homogenous markets. We therefore concentrate on the second strategy which appears to match more closely differentiating, heterogeneous markets.

The main link between properties of the product market and the organization of work and skills appears to be batch size - of products, components and parts- and strategies to translate product demand and variety into batches of components and parts. Experience from studies about "new technology" shows that when large batches are produced, the organizational and skills solution found is characterised by higher and more rigid segmentation of steps and jobs in the workflow, as well as by a more polarized distribution of skills; in the case of smaller batches, we find less segmented and more overlapping workflow organization and a less polarised distribution of skills (Sorge et al. 1983). This is an effect which extends through more or less the whole organization, not only to "boundary-spanning components" such as marketing or research and development. The latter, more restricted and concentrated effect, appears to be correlated with the "classical" diversification mode referred to above which is less relevant here.

The effect we are dealing with is not so new, and it brings back the distinction between production continuity and workflow integration referred to earlier. Workflow integration can be seen to follow a concern to achieve high output in complex and capital-intensive
systems. It may thus be a permanent feature of all technical change that produces complex and capital-intensive production systems. But production continuity is another thing: Where batches are smaller, there is a constant need to retool, reset, replan, reprogram, redesign and adapt to fluctuations of inputs due to discrepancies between planned or standard material quality, workpiece measures, design details and scheduling dates on the one hand and actual or unforeseeable values, specifications and dates on the other. Any reduction of the size of batches in a complex organization restricts the usefulness of constraining standards and central plans. This makes for workflow discontinuity and thus gives rise to needs for developing and involving human competence, as both the socio-technical literature and industrial sociology in another tradition have shown (Lappe 1986; Human Systems Management 1986).

By relating organization and skills to goods market properties, we do not intend to replace a technical with a market determinism. A company may as well look for a market niche to match its organizational strategy, or it may serve the market in a way that tallies with what it perceives to be its organizational and skills strengths. It can be shown that, for instance, the economic and employment success of the German car industry in the 1970s and 1980s, when compared to the car industries of other countries, was strongly related to the pursuit of more qualitatively differentiated and quality-conscious markets. Success in such markets was conditional on the production of craft skills and their utilization for organizational flexibility. For this, German firms with the comparatively high skill level of their workforces were particularly well placed. Moreover and at the same time, they were constrained by their works councils to increase their vocational training efforts in response to youth unemployment; improve the quality of working life through task enlargement and task enrichment; avoid redundancies through retraining and redeployment in a co-determined internal labour market etc. Given these pressures, it has been argued that, like the Swedish car manufacturers, they had little choice but to opt for an alternative to traditional price-competitive mass production (Streeck 1986).
Long-range changes in organizational and qualificational strategies, and the resulting shift in the major explanatory approaches in industrial sociology and organization theories, cannot be due to a sudden, simultaneous increase in companies' awareness of socio-technical choice or the potential in smaller and more differentiated markets. For assessing the roots, the extent and the duration of factors which load socio-technical choice one way or the other, it is not enough to say that there is a choice or on which contexts alternatives depend. One needs a concept of how a society or economy is populated by technical and organizational types, and how this population changes over time. This has recently been discussed in the "organizational ecology" literature, by authors such as McKelvey (1982) or Trist (1981). We cannot comment on it adequately here, and we only argue that organization and skills are presently very much influenced by rationalization strategies aiming at a reduction of work-in-progress, stocks and throughput times, which, in the face of less homogeneous and less mass-type markets, reduces batch sizes of components and parts and thus feeds into organization and skilling policies.

Piore and Sabel (1984) have suggested that the revival of craft skills is linked to a transition from mass markets to more differentiated, quality-conscious and shifting markets. This development is not something radically new. Nor is it necessarily here to stay; one should guard against assuming this trend to be ever-lasting, given the demise of past ideas about a continuing trend towards mass markets and the degradation of skills. We may be dealing with a cyclical phenomenon whose nature and causes are not known and in bad need of research. But the revival of interest in Kondratieff or innovation cycles has not been entirely helpful either, being confounded by a number of methodological errors and difficulties (Maddison 1982). At the moment, one may only speculate (Firebaugh 1983; Sorge 1985, Chapter 7) on the basis of limited empirical evidence and vague theoretical conjectures. We know that there are such cycles, but we know very little about their causes. But we do appear to know that, despite the uniqueness and different duration of each cycle, their
phases seem to be governed by increasing returns to scale or scope, respectively.

An intermediate summary is that we appear to be in a phase where the renewed emergence of shifting markets has put a premium on an organizational and skills formation strategy that often appeared to go against the tide in the post-war boom period. This has revived interest in Adam Smith's theme of the "size of the market". Large homogeneous markets can be thought of as the corollary of a polarizing regime, whereas smaller and more heterogeneous markets are functionally related to a more organic socio-technical approach (Sorge 1985; Warner 1985). However, we do not suggest that organizations respond elastically and in the same way to a new or re-emerging set of conditions in goods markets. This is partly a matter of the extent to which a company already has some affinity to the appropriate strategy; is "turned round" by leading actors; or finds itself in a national-institutional context that has already made the respective strategy appear more opportune.

In our earlier research, we have shown national differences that bear on the capacity to respond to new market conditions of differentiation and changeability. The institutional context of Germany has favoured the development and quantitative proliferation of craft skills, less polarized distributions of skills, less job demarcation, and greater overlap between laterally and hierarchically differentiated work roles (Maurice et al., 1980). Further below, we will demonstrate that the division of labour is closely related to structure and processes of industrial relations. This will yield a concept of an interaction between organization, skilling and industrial relations which is not deterministic but rather emphasizes common logic or "elective affinity" that may be the result of reciprocal causation and interacting strategic choices.
3. Technical Change and Industrial Strategy

Close analysis of the relationship between technical change and the organization of work and skills draws attention to the impact of product markets and the formation of product strategies. But just as technology does not determine work organization, markets and products do not determine technology. New products tend to be accompanied by process innovations, and advances in process technology may enable firms to change to new products. But it may also be possible to produce a given product with different technologies, just as a given technology may be capable of producing a range of different products. In principle, then, there is always room for strategic choices between products and markets even without technical restructuring, and firms may also have a choice between different trajectories of technical development while continuing to produce for the same market. In this sense, technology and product are as "loosely coupled" as are technology and work organization.

Technology does not determine industrial strategy - or, to use a term suggested by Willman (1985), "manufacturing policy" - but rather offers options from which managements, trade unions and industrial policy-makers can select. This applies in particular to micro-electronic circuitry which can be put to essentially two different uses, corresponding to different product strategies. On the one hand, it can be used for rationalization within traditional mass production, i.e. to save labour and to reinforce and extend the separation of conception and execution. Used in this way, micro-electronics make it possible for producers to supply standardized products at lower prices, thus increasing or restoring their competitiveness in mass markets. In addition, it seems that micro-electronic technology has changed the economies of scale in mass production in that it enables manufacturers to reach the break-even point with much smaller batches than in the past. This has helped smaller firms survive in industries, such as automobiles, which according to widely accepted predictions should by now consist of no more than three or four "mega-producers" (Altshuler et al. 1984, 181ff.). For the same reason, new
technology facilitates strategies of reorganization that rely heavily on capacity cuts, downscaling of operations, and the shedding of labour.

On the other hand and at the same time, micro-electronics can also be used to rid manufacturing industries of the principal limitation of traditional mass production, the high rigidity of production equipment. Micro-electronic equipment can be so designed as to be far less dedicated to given products than equipment automated on the basis of conventional electronics, electromechanics, mechanics, hydraulics, etc. Since machinery equipped with microelectronic controls is easily retooled, it can be used for highly diversified production of individualized products, at costs rising less than with previous purpose-specific technology. In this sense, micro-electronics, in addition to changing the economies of scale, makes it possible to reap increasing returns to scope (Sorge 1985, Chapter 3) from the introduction of high product variety in large-scale manufacturing processes. Moreover, micro-electronic production equipment can be utilized to improve product quality. The resulting type of customized, diversified high-quality products responds to non-mass markets in which competition is not only over the price of basically homogeneous goods but over product quality and the degree to which products meet the special needs of individual customers.

A more systematic analysis of the alternative manufacturing policies that new technology enables firms to choose from would probably emphasize three variables: the degree to which products are standardized; the type of competition to which they are exposed; and the volume in which they are produced. The first two factors seem to be closely related in that standardized products are generally sold in price-competitive markets whereas customized products tend to be quality-competitive. This suggests a distinction between standardized price-competitive and customized quality-competitive production on the one hand (Cox and Kriegbaum 1980), and low and high volume production on the other. Production volume is, of course, a function of production unit size and factor productivities. Since we do not en-
visage a drop in labour productivity but only slower increases; and since size of production units and standardization of products cannot be conflated, it is important to distinguish the two dimensions, of volume and of standardization of production. Small batches may be beautiful in small or large units, with small or large volume, alike. The same applies if "beautiful" is replaced by "ugly".

Crossing the two dimensions, one arrives at four alternative product, or manufacturing, strategies (Diagram I) whose relationships with technology seem to be central for understanding present processes of industrial restructuring. Of the four possible types of manufacturing strategies defined by the two dimensions of our contingency table, two - the low-volume production of customized quality-competitive goods and the high-volume production of standardized price-competitive goods – look familiar, and indeed with some simplification one could say that before the advent of micro-electronic technology, theirs would have been the only cells in the matrix that would have been filled - apart from the small suppliers of specialized components to mass production that might be seen as inhabiting Cell 1. This comparatively simple picture has now become considerably more complicated. For example, it has already been mentioned that new technology may have lowered the break-even point of mass production, thus eroding somewhat the boundary between Cells 3 and 1. On the other hand, a small component producer (Cell 1) dependent on a large assembler may under the new technical conditions find it attractive to move into craft production (Cell 2) by developing and differentiating his product range, so as to become less dependent on price fluctuation and monopsonistic demand. Moreover, by lowering the costs of customized high-quality production, new technology has not only opened new avenues of expansion for previously dependent suppliers but has also made it possible for small specialist producers to remain, or again become, economically viable (Cell 2) – which may put a brake on, or reverse, the concentration of manufacturing industries.

The most important impact, however, of new technology on manufacturing strategy seems to be that it has made it possible to fill another
Diagram I

A Simple Classification of Product Strategies

<table>
<thead>
<tr>
<th>Low Volume</th>
<th>Standardized Price-Competitive Products</th>
<th>Customized Quality-Competitive Products</th>
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<tbody>
<tr>
<td>Specialized Component Production</td>
<td>Craft Production</td>
<td></td>
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<tr>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>High Volume</td>
<td>Mass Production (&quot;Fordism&quot;)</td>
<td>Diversified Quality Production</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
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off-cell in our matrix by creating a new option of high-volume production of customized quality-competitive goods (Cell 4). In many sectors of manufacturing industry, micro-electronic circuitry has progressively eroded, in the course of the past decade, the traditional distinction between mass and specialist production. The high flexibility of micro-electronic equipment and the ease and speed with which it can be reprogrammed have enabled firms to introduce a hitherto unknown degree of variety, as well as quality, in large batch production. The result is a restructuring of mass production in the mould of customized production, with central features of the latter being blended into the former and with small batch production of highly specific goods becoming enveloped in large batch production of basic components or models. This new pattern - which we prefer to call "diversified quality production" since the more general term, "flexible specialization" (Piore and Sabel 1984), has become too closely associated with the notion of small, independent craft firms (Cell 2)\(^2\) - can be approached via two different trajectories of industrial restructuring: by craft producers extending their production volume without having to sacrifice their high quality standards and customized product design (moving, so to speak, from Cell 2 into Cell 4) or by mass producers moving upmarket by upgrading product design and quality and by increasing product variety in an attempt to escape from the pressures of price competition and from a market segment which seems to be becoming smaller (starting, as it were, from Cell 3). Industrial restructuring towards diversified quality production is now generally regarded as a highly promising strategy for old industrial, high wage economies striving to remain competitive in more volatile and crowded world markets while at the same time trying to protect their employment in manufacturing.

\(^2\) In fact, we are arguing that precisely because new technology enables large firms to avail themselves of the organizational means to render their own design and production more flexible, their chances of competing in the changed ecology of product market types may not at all suffer. There is good reason indeed to guard against an unbridled "small is beautiful" philosophy.
Firms in Cells 2 and 4 operate and thrive where the premise of increasing returns to scope applies, i.e. where it pays to differentiate and upgrade the product range. Firms in Cells 1 and 3 operate and thrive where increasing returns to scale are seen to exist, i.e. where it pays to specialize and standardize production. Successful operation in Cells 2 or 4 may lead to a growth in market shares which may be linked to a growth of volume. This might move the firm away from Cells 2 or 4, but only if a growing market share is not linked to growing product market differentiation. Therefore, while it is conceivable that success in one cell may lead to a movement to the boundary of that cell or beyond, neither the existence nor the direction of such a movement can be taken as given. They depend on how an economy's or society's ecology of product markets evolves, and how this is interpreted by crucial actors. Moreover, even if shifts of emphasis between cells occur, there is not necessarily a zero-sum game between firms with different manufacturing strategies. An increasing population of Cells 2 and 4, for instance, may require an increasing population of Cell 3 by manufacturers of standardized and mass-produced multi-purpose electronic devices, such as memories and microprocessors which are required for flexible control equipment.

New technology, since it may improve firms' survival chances in any of our four types of production, does not as such determine manufacturing policy. If at all, it seems to extend rather than narrow down the range of available choices. Which package of products and processes a firm selects depends above all on the opportunities it perceives in product markets. But since production technology and the way in which it is utilized is also related to the organization of work, the choice of new manufacturing policies is in addition conditioned by, and may require restructuring of, the socio-technical production system. The latter, in turn, relates back to the labour market and the supply of skills that is on offer.
4. The Role of Industrial Relations

Up to now, we have found technical change to interact closely with the organization of work and skills on the one hand and firms' strategic choices of products and markets on the other. In particular, we have seen that the way in which technology is integrated with work organization in socio-technical systems is conditioned by the markets to which industrial organizations (choose to) respond. We now proceed to discuss how industrial relations fit into the picture.

The principal, "bread and butter" themes of industrial relations have always been wages and conditions, with macro-economic demand management and control of inflation supplementing the discipline's original micro-perspective in the corporatist 1960s and 1970s. According to Dunlop's seminal definition of the "industrial relations system" (1958), technology is not a subject of joint regulation but one of its three main environments, the other two being the market and the distribution of power in the larger society. Just as these, technology, or technical change, affects the operation of industrial relations systems from the outside. The output, as it were, of industrial relations systems consists of a "web of rules" that governs "the workplace and the work community", i.e. the organization of work. To the extent that technical change "requires" changes in work organization, it may bring pressures to bear on rule-making bodies to negotiate, impose or accept normative adjustments. It is also conceivable in the model that rigid or inert rule systems, perhaps defended by one or another interested party, stand in the way of introduction or full utilization of particular new technologies. In any case, however, technology as such remains an exogenous factor which in itself is outside the scope of functionalist-pluralist rule-making.

It is not a long way from here to the notion that technology, just as for example product strategy, is a "managerial prerogative", and that the role of industrial relations with respect to technical change is properly restricted to regulating its consequences in the workplace.
but not its substance or direction. This view, in turn, is closely linked to an idea of technical development as an essentially unilinear and unidimensional process which is either interest-neutral (the "pluralist industrialism" tradition - Kerr et al. 1960) or closely identified with the interests of management (the radical position as held by Braverman 1974 and Fox 1974). The consequence is the same: there is in principle nothing to negotiate.

It is only consequent on this background that in mainstream industrial relations research and theory, the themes of technology and technical change appear almost exclusively in terms of "resistance to change" or "acceptance of innovation" (Willman 1985). For the practical art of conducting "good industrial relations", the task was essentially to design "pluralist" procedural rules that facilitated the consensual, frictionless adaptation of substantive rules to whatever the exogenous process of technical development required. Among the main preoccupations of the discipline in this respect has been to compare different industrial relations systems in terms of their "openness" to technical change. Among the variables that were used to distinguish industrial relations systems for this purpose are:

- the extent to which workers are represented by craft unions organizing only skilled workers of specific occupations, as opposed to company or industrial unions representing workers of all occupations and skill levels in a given firm and industry;

- the degree to which negotiations are centralized above the shop floor level, i.e. are conducted for entire companies, industries, or nations;

- the relative importance of job control as compared to industrial democracy, i.e. the extent to which rights of workers to participate in managerial decisions are located on the shop floor and relate to the design of individual jobs, rather than being institu-
tionalized at the enterprise level and referring to the firm's overall commercial strategy;

- the role of the "external" as distinct from the internal union in collective bargaining, in particular the degree to which collective bargaining is controlled by full-time trade union officials outside the individual firm;

- the degree to which industrial relations are conducted under mutually recognized (formal or informal) "rules of the game" which separate clearly the domains of joint regulation from those of managerial prerogative;

- the extent to which substantive matters such as working conditions, employment and social security are regulated by legislation as distinct from industrial agreement, and the extent to which trade unions as a consequence (have to) rely on "political" as opposed to "industrial" action.

Underlying these distinctions, and apparently confirming their validity, was the observation that firms, industries or countries with industrial or company unions, relatively centralized negotiations, industrial democracy, well-formalized demarcation of spheres of influence for management and trade unions etc. experienced less resistance to, and more consensus on, technical change than was found in the absence of these conditions (for example, Jacobs et al. 1978; Hotz-Hart 1987; Maitland 1983). Although in some respects the evidence was not unambiguous, in the United Kingdom in particular it provided the basis for a liberal-pluralist programme of industrial relations reform which culminated in the Donovan Report of 1968, calling for more "orderly" industrial relations as a precondition for improvements in economic performance through technological and organizational modernization.

The idea of institutional reform was closely linked, in Britain and elsewhere, to the identification during the 1960s and 1970s of
various "models" of industrial relations systems that were believed to be ideally suited, among other things, to accommodating technical change: the United States with its high degree of legal formalization, Sweden with its encompassing industrial unions, Germany with its "peculiar institution" of co-determination, and lately Japan. However, all attempts to transfer model institutions of industrial relations from one country to another have failed. Radical opponents of the liberal "Oxford School" in Britain have explained the persistent "disorder", in the face of repeated attempts at reform, with reference to the fundamental inequality between capital and labour which renders the achievement of distributive consensus impossible. As its key witness, the critique of industrial relations institutionalism adopted the early Durkheim, the author of the famous verdict in the "Division du travail" that "there cannot be rich and poor at birth without there being unjust contracts" (Durkheim 1964, 384). This, it was suggested, was why capitalist societies are beset by inherent anomic tendencies which are the real causes of, among other things, the rising rate of inflation (Fox 1974, 322; Goldthorpe 1974). Persuasive as this argument may appear, however, it does not provide the conceptual equipment to account for cross-national differences in either industrial relations conflictuality (Maitland 1983) or inflation rates.

On the other hand, in its most advanced version (Fox 1974) the radical critique of pluralist institutionalism raises the theme of technology in a way which is highly instructive. Industrial anomy, according to Fox, is the result of a proliferation of "low trust" which starts in the Taylorist organization of work. Fox assumes, and never doubts, that to achieve efficiency managements have to organize labour in such a way that tasks become ever more standardized and subdivided (Fox 1974, 59, 96, passim). In a brilliant analysis that mobilizes the power of a long sociological tradition, Fox proceeds to argue that the persistent efforts of the "high-discretion fraternity" of managers to curtail the discretion vested in the work roles of their organizations' "lower participants" are bound to erode the capital of trust and good will that is a necessary precondition for
contractual relationships to function (Fox 1974, 87f.). A Taylorist organization of work - as required by the economic imperatives of mass production - thus generates its own conflicts and crises in that it gives rise to calculative and "irresponsible" attitudes on the part of workers (Fox 1974, 64, passim). It also induces workers to try to defend themselves collectively by imposing in turn similar limitations on managerial discretion through formalized, specific rules and procedures (Fox 1974, 113). It is here that, among other things, "organizational rigidities" and "restrictive practices" against technical change arise as rational responses by workers to their subordinate position in the organization of work.

Fox's criticism of the "Oxford School" appears convincing enough where it points to the futility of procedural-institutional reform as a means of curing problems that are deeply rooted in work organization and technology. At the same time, if the assumption of the coincidence of economic rationality with mass production and Taylorism was relaxed - as we have strongly suggested it should be - the movement towards industrial anomy would look somewhat less inevitable, and it might also appear possible to explain different degrees of anomy and conflict in industrial relations by differences in socio-technical systems and the generation and utilization of skills. Fox, however, does not follow this path and cannot do so given his unquestioned acceptance of the mass production view of technology and efficiency. To him, cross-cultural differences in work organization are basically due to time lags in the modernization process, and indeed in a special section on Japan he predicts that the more organic Japanese organization of work will shortly fall victim to economic pressures for "Westernization" (Fox 1974, 131-5). It is hardly necessary to mention that today, the pressure goes exactly in the opposite direction. While Fox is undoubtedly right where he refutes the idea that industrial inefficiency could be remedied through "better" procedures and institutions of industrial relations, he neglects the possibility that the crisis of both industrial relations and industrial efficiency in Britain in the 1970s may have been a result of particularly heavy reliance on Taylorist modes of (low-skill) work
organization combined with and in response to historically privileged access and prolonged exposure to mass (world) markets.

Turning to technical change in particular, the liberal reform tradition operated on the premise that "resistance to change", and insistence on inefficient "restrictive practices", is caused by informal, fragmented, decentralized, disorderly industrial relations privileging "conservative" short-term over "enlightened" long-term interests of workers. In opposition to this view, it has been argued that the interests pursued by such unions are quite rational, given the organization of work and skills in which they have to operate. While we tend to support the second position, we are not discarding altogether the first, "Olsonian" one. Indeed, we believe that both may be valid at the same time. While a fragmented, sectional, job control-based industrial relations system may give rise to "rigidities" in work organization that impede technical change, the inverse effect may also exist: industrial relations "rigidities", rather than being the source of adjustment problems of work organizations to new technology, may simply reflect them.

For example, a high degree of separation of conception and execution inside the organization of work is likely to give rise to contests over managerial prerogative which would not emerge where the differentiation of functions is less pronounced. This applies in particular when, in the course of introduction of new technology, the existing division of labour needs to be reorganized. While in a more organic work organization adjustments to technical change can often be made within individual work roles, under high functional differentiation between "management" and the shop floor, adjustment problems tend to be transferred into the industrial relations system where they are typically transformed into matters of pay and conditions. In this sense, systems of work organization with "much management" tend to have "more industrial relations" - conceived of as a specialized area
outside production management - than organic systems with functionally diffuse work roles.  

The crucial factor, as we have pointed out in earlier work (Sorge and Warner 1980; Streeck et al. 1981), is the way in which skills are defined, generated, and organized into occupational career trajectories. Industrial unionism, and the accompanying willingness of unions to accept technical change, is conditional upon some degree of mobility between occupations; this, in turn, presupposes broad general skills that provide a basis for further training and reversible specialization. Craft unionism defends rigid inter-occupational boundaries, which correspond to narrow skills that are difficult to adjust. Where the latter type of skill prevails, workers will tend to define "qualification" as an entitlement to perform certain, fixed and specific tasks. Firms, on the other hand, will depend for adjustment to technical change on a "managerial prerogative" to hire and fire workers as the only way to change the skill composition of their workforce. In response to the high external flexibility that firms are forced to defend, workers will insist on strong internal rigidities protecting the tradeability of their skills on the external labour market. External flexibility and internal rigidity, in their "affinity" to narrow skills, a strong external labour market and a high division of labour, are compatible with economic performance as long as there are enough skilled workers available on the external labour market, and employed workers lack the power or the incentive to constrain firms' ability to hire and fire.

The situation is quite different where skills are broad enough to permit extensive internal retraining and redeployment. In this case, workers will find it less necessary to engage in sectional defence of

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3 This may be one reason why in a country like Germany, the very concept of "industrial relations" has failed to take root. Another case in point is the often-observed low ("undeveloped") differentiation of company unions from lower and middle management in the "organic" work organization of Japanese firms - where many of the functions of both management and trade unions are incorporated in the work group (Deutschmann 1986).
job territories. Since the external transferability of their broader skills is not damaged by redeployment and retraining inside their present organization of work, they can afford to accept a flexible allocation of work tasks. This, in turn, makes it possible for management to make concessions on employment security, and for workers to define their interests in terms of imposing external instead of internal rigidities on management. A flexible internal labour market in a less functionally differentiated organization of work also invites trade union participation in the management of redeployment - i.e. some form of shared responsibility under industrial democracy or co-determination for an efficient functioning of the internal labour market (Streeck 1986). Moreover, broadly skilled workers, being in a position to give up job control in favour of a combination of external rigidity and internal flexibility, are likely to find their interests most adequately represented by unions which negotiate general rules - susceptible to and, in fact, in need of formalization - rather than locally idiosyncratic, "informal" job territories. This, in turn, is conducive to trade union reliance on political action, and to "incorporation" of trade unions in public policy and public responsibility. Where the division of labour and authority is less developed, defence of the interests of workers can be less localized, is easier to subject to formal and general rules, and interest representation can be removed from the shop floor to higher levels of collective action. It is against this background that the paradoxical coincidence of extensive legal regulation with high shop floor flexibility in Germany, and "voluntary" industrial relations with extreme rigidities in the organization of work in the United Kingdom (at least until the early 1980s), might be explained.

Again, there is a connection with product markets and product strategies. To Anglo-Saxon observers in particular, one of the extraordinary features of German trade unions is their untiring support for, and active political commitment to, an expansion and upgrading of vocational training. This is in spite of the fact that from a pure labour market perspective, any increase in the supply of skilled labour is bound to depress its price, which is precisely why craft
unions in the United States and the United Kingdom have always tried to limit the number of apprentices in their respective trades. The reason why German trade unions apparently act against their own interests is their strong awareness of the exposure of German industry to a highly competitive world product market. As latecomers to industrialization which had to find opportunities for expansion outside the protected markets of established mass producers, German firms have from early on specialized in diversified quality products, with high service intensity and customized design. It was this characteristic market strategy that made it possible for employment in German manufacturing to remain more stable than in any other old industrial country, in spite of trade unions having learnt over time to expect and extract high real wages. Today, German unions in exposed sectors are conscious of the fact that high-wage manufacturing industries in old industrial countries can survive only with a flexible quality production system based on a large supply of broad, adjustable skills. This is why they support a training system which, precisely because it tends to produce an oversupply of skills, facilitates an organization of work that can relatively easily cope with technical change (Streeck 1986). And it is this configuration in the organization of work and skills which both sustains and is sustained by an industrial relations system that is non-sectional, encompassing, formalized, legally regulated, and centralized.\(^4\)

National patterns of skill formation represent an important element of the "societal effect" by which Maurice et al. (1980) have explained cross-cultural differences in the division of labour and the organization of work. To the extent that such differences are, as we hope to have shown, related to different patterns of industrial relations, they appear to offer a better explanation than that suggested by the radical Durkheimians for the lack of success of liberal-re-

\(^4\) It is obvious that our analysis draws heavily on the German case and on its differences to countries like the United Kingdom or the United States. But we believe that with appropriate modifications, the argument can easily be extended to other countries such as, for example, Japan or Sweden on the one hand and France and Italy on the other.
formist projects to transplant institutions of industrial relations from one country to another. Liberal-pluralist institutionalism seems to be frustrated not so much by a general trend towards low trust and anomie in capitalist society, as by the complex interdependence of industrial relations institutions with a wide range of economic, social and cultural factors. Together these seem to form distinctive configurations of interdependent elements - "historical individuals", in Max Weber's terminology - that may operate as vicious or virtuous circles depending on the circumstances, and that seem to be highly resistant to purposive, "mono-causal" intervention due to their inextricable internal complexity.

5. Conclusion: Technical Change, Industrial Relations and Trade Unions

Technology and technical change interact with a firm's product strategy on the one side and its work organization on the other (Diagram II). By interaction we mean a loosely coupled relationship of mutual dependence in which directions and mechanisms of causation may vary under different internal and external conditions (Weick 1979). Moreover, the density and determinacy of the interrelation between product, process and work organization are in part a matter of strategic organizational choice as each of the three can be designed to be more or less autonomous of the others. Both product strategy and work organization, in turn, are related to crucial organizational environments - the former to the product and the latter to the labour market including the qualificational structure of the labour supply and the societal system of skill formation. Here again the relationship seems to be one of mutual interaction rather than unilateral dependence (for a more detailed discussion of the model, see Streeck 1985).

Management and trade unions - including institutions of workplace representation such as works councils and shop stewards - relate to the two markets and the three areas of strategic organizational choice in significantly different ways. In a simplified and ideal-typical model
Diagram II

Technology and Industrial Relations in Context

Management

Firm

Union

PRODUCT MARKET

PRODUCT STRATEGY

TECHNOLOGY

WORK ORGANIZATION

LABOR MARKET

Marketing

Engineering

Manpower Management

Wage Bargaining

Co-Determination

"Job Control"

Wage Bargaining
which is to serve as an analytical baseline for a more complex picture of the politics of the relationship between product and labour markets - the interests of managements and unions have in common that they are directed at reducing the complex set of interactive relationships summarized in Diagram II to a sequential order of unilateral dependence constituting a consistent hierarchy of causal determination and decision-making criteria. Interests differ, however, in that the two sides' preferred decision sequences run in opposite directions. For the management of a firm operating in a competitive market environment, product strategies have to follow the signals of the market; technology has to follow both product design and competitive (market) pressures for low production costs; and work organization has to be fitted to the adopted technology so that the resulting products can optimally exploit the opportunity structure of the market. Finally, how much and what kind of labour is hired, and at what price, is determined by the requirements of an "optimal" organization of work, and it is the task of collective bargaining to ensure that the labour market supplies exactly what the firm needs. Marketing, therefore, governs product and process engineering, and these together control the manpower function, including collective wage bargaining, which is relegated to the receiving end of the managerial decision-making process.

For trade unions, by contrast, the ideally preferred sequence takes off at the labour market. By acquiring control over the supply of labour through organization, trade unions try to define wage levels, skill structures and employment conditions to which firms then must adjust their organization of work. "Job control" inside firms further adds to the pressures on work organization, trying to make it responsive to demands for promotion opportunities, skill enlargement, control of discretionary authority etc. At the next level, technology would then have to be so designed as to be compatible with the structure of the labour supply and with the preferred organization of work (which is in fact what unions try to achieve through "technology agreements"). To the extent that the resulting technology is "dedicated" to a particular category of products, trade union interests
require that product strategies be matched to technical choices, rather than vice versa. The final step in this sequence would be a system of bargained regulation of the product market, extending beyond the level of the individual firm in the same way as collective bargaining extends to the labour market. Such systems, however, do not normally exist, and it is here that the apparent symmetry of the positions of management and trade unions comes to an end.

Trade unions unlike management are formally involved in a firm's decision-making only as far as it relates to the firm's external and internal labour markets, and the linking of the two through hiring, redundancy and training policies. As a result, important parameters affecting the choice and design of new technology are outside their institutionalized sphere of influence. Lacking a collectively bargained product market, trade unions are limited to creating "institutional rigidities" at the lower end of the managerial decision-making sequence that constrain management's decisions on pay, work organization and, in part, technology. While superficially these rigidities correspond to those of the product market represented by management and constraining trade unions, the primacy of the product market over the labour market, far from being merely the preference of one of two rivaling parties, is strongly institutionalized in the structure of a competitive market economy. It is also, and correspondingly, institutionalized in the limited domain of the functionalist-pluralist subsystem of industrial relations, as represented by the dotted line in Diagram II. Product strategy, which affects technology as much as does the organization of work, is not included in the area of joint regulation since it is supposed to be exclusively governed by the product market. Another source of asymmetry is, of course, that inside the industrial relations system trade unions, unlike management at the firm's product market boundary, have to share power with management under joint regulation.

The power of trade unions to create rigidities in the labour market is conditional on the structure and level of demand in the product market whereas the power management derives from representing the im-
peratives of the product market is independent of the labour supply. If product demand is high, demand for labour is also high, and trade unions can successfully press for regulations that limit managerial discretion on employment and working conditions. But if products no longer "fit" the market, trade union power is bound to wane, and management may be presented with the opportunity to roll back labour market rigidities in a way which in a market economy is not normally available to trade unions in relation to product market "rigidities". Due to the hierarchical superiority of product over labour markets, maladjustment of firms or industries to product demand constitutes a source of power for management and enables it to reaffirm the hierarchical sequence of control from product strategy to technology, work organization and finally, labour demand. Maladjustment to the supply of labour, on the other hand, does not bestow comparable power on trade unions, and it is this fundamental asymmetry that gives rise to the structural inferiority of trade unions in a capitalist economy.

But this is not the whole story. Managerial product strategies - "manufacturing policies" - respond to the market but are not determined by it. Market signals are never decisive - partly because active marketing may be able to change them, and partly because even the best marketing department cannot safely predict where future profits will be found. Moreover, there is always a variety of markets from which firms can choose, the most basic distinction being that between mass and specialized, or price- and quality-competitive, markets. Firms also have a limited but nevertheless significant degree of choice with regard to their own performance standards, with firms differing among other things along organizational, sectoral and national lines in terms of the time they are willing to wait for investment to become profitable. Finally and most importantly, economic and technical change, as we have argued above, have enlarged the matrix of strategic choice for firms in manufacturing and have simultaneously made the coupling between central areas of choice, such as product strategy, technology and work organization, less determinate and richer of functional alternatives and equivalents.
Uncertainty and indeterminacy create space for alternatives in commercial strategy which make it possible, and inevitable, for managements to take into consideration other factors than the market. Previous investment in a specific manufacturing organization and technology may commit managements to a particular product strategy. Trade unions and industrial relations may also be of importance in that they affect the available skill mix and the relative prices of labour. Since the market cannot fully determine strategic production decisions, the rigidities created by trade unions at the labour market end of the managerial decision-making hierarchy operate as a set of constraints and opportunities that influence strategic managerial decision-making - if only inadvertently. If a product strategy that has been adopted in an attempt to accommodate existing organizational structures and labour market conditions yields satisfactory results by the firm's "culturally" and "politically" defined performance standards and is accepted to remain successful, there is no need for management to challenge industrial relations "rigidities" even if they prevent it from pursuing alternative strategies. It is towards these multi-causal and interdependent relationships that trade union policy might turn for re-orientation in an era of extended and renewed strategic choice in both manufacturing policies and industrial relations (Kochan et al. 1984).

Many of the problems that trade unions face in the 1980s result from attempts of managements to erode the boundaries between firms' commercial experience and the institutional subsystem of industrial relations whose "relative autonomy" from fluctuations in the economic situation of enterprises and industries was established in the post-war period (Strauss 1984). Underlying such efforts are fundamental changes in the economic environment which require firms to react more directly to more volatile market conditions. One way of becoming more flexible is by integrating industrial relations and manpower policy into comprehensive commercial strategies, tying the functionally differentiated areas of marketing, product design, process engineering, work organization and skill formation more closely together. Tendencies of this kind are almost universal in the present restruc-
turing process, and it seems that their wide presence is related above all to the potential of new technology for more flexible manufacturing.

For trade unions, the traditional separation of industrial relations from marketing, finance, and product and process engineering once offered a degree of shelter and protection for independent action in the defence of their members' interests. However, now that it has become increasingly unlikely that the subsystem boundaries of the 1950s and 1960s can be defended or reestablished, independence may increasingly come to mean irrelevance in the face of a much more tightly coordinated managerial decision-making process. The only alternative for trade unions may be to develop an integrated strategy of their own, by extending their strategic concerns "upwards" beyond the traditional subsystem limits of industrial relations. In trying to do this, they can be supported by more careful empirical examination, not least on a comparative, cross-cultural basis, of the impact, hitherto largely unintended and latent, of trade union presence and action on the conception of commercial strategies—which might enable them to put the respective causal links and connections to strategic use.

"Workers' control" of industry, as a form of industrial democracy that extends beyond negotiations of pay and conditions to include the "politics of production", was a "radical" project in the 1960s and 1970s, allied with a perspective beyond capitalism. It was as much a reaction against mainstream industrial relations, with its functionalist perspective and its functionally differentiated area of concerns and mode of operation, as it tried to formulate an alternative to the capitalist mode of production. Today, it is generally viewed as a marginal and rather unsuccessful movement which has more or less withered away.

But this is not what our analysis suggests. Giving up the comprehensive perspective of the radicals just because of the turning of the political tide in the 1980s may be premature. This is because there
has also been a turning of the tide in product markets that puts a premium on a type of industrial relations in which trade unions are both constrained and offered the opportunity to bear a much more conscious and explicit regard for product, marketing and technical strategies. In many ways, this development seems to vindicate the labourist, syndicalist and socialist doctrines of yesteryear that have unceasingly insisted on a strong link between the politics of labour markets on the one hand and of production on the other, both as a precondition of effective representation of worker interests and as a strategic lever for societal transformation.

At the same time, however, it also appears that the turning of the tide, both political and economic, has taken the radicalism out of what was once a project of fundamental political change. What may initially have been a revolutionary idea seems to have become, under new economic conditions, a necessary requirement of competitive economic performance in world markets. Unions moving in the direction of a comprehensive production strategy away from mass production are likely to help capitalist firms link successful marketing and production with peace at the workplace. Once more, Janus appears to rear his head, and to the radicals it may this time be a particularly ugly one: a programme of fundamental social change performing a latent function for social system integration - and possibly also for social value integration which, pace Lockwood (1964), may not after all be so independent of the former.
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ZITIERWEISE/CITATION:

Arndt Sorge/Wolfgang Streeck:
Industrial Relations and Technical Change: The Case for an Extended Perspective
Discussion Paper IIM/LMP 87 - 1
Wissenschaftszentrum Berlin für Sozialforschung 1987

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