From Stephen Wood (ed.), THE TRANSFORMATION OF WORK? (London: Unwin Hyman, 1989)

many open heart operations?) can undergo changes. The same is true of who treats them (in the sense of the balance between medical, nursing and ancillary labour required) and of where they are treated (in GP clinics? in day surgery? through preventative methods?). To put it another way, the combination of changes in management systems and in the use of more efficient information processing systems can result in improvements in health care productivity and efficiency (the declared aim of the NHS reorganizers) and also a re-cast of what the NHS actually offers as health care. The combined effects of financial pressures and improved awareness of the actual costs of procedures has resulted in the NHS contracting out some medical services (such as surgery) to the private sector, whilst simultaneously selling other services (such as scanning) to the private sector.

Any changes that are possible in a service product, to return to Gershuny and Miles's terms, will be part of an ongoing reorganization of the service industry concerned, both internally and in its transactions with its customers or clients. These changes, may, however, be under way for reasons unconnected with technological changes, caused instead by shifts in resources or straightforward political intervention. These trajectories of organizational change interact with, and change the opportunities for, the utilization of new technologies. Changes in the work tasks of the various groups of workers in these organizations will depend on how these interactions work out. It should be clear that it is not possible to forecast in detail changes in the work organization of the NHS, or of groups within it, which are deemed to flow from the use of new technologies, whether for information processing or for clinical diagnosis. Information technologies and new diagnostic tests only affect work organization by way of their interaction with organizational innovations which are taking place for reasons not directly connected with the technological innovations. Detailed studies of changes in work organization for particular groups – nurses, secretaries, doctors, laboratory technicians – must not over-concentrate on changes in the details of day-to-day work that the use of new technology requires. They must also be concerned with broader transformations in the overall work-organizations. But it must also be remembered that new technologies and new organizational imperatives alter not only the way in which the service product is delivered, they alter what the service product is.

16 *What is socialist about socialist production? Autonomy and control in a Hungarian steel mill*

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Are there features which distinguish production in state socialist societies from production in capitalist societies?[1] Can one talk of a capitalist as opposed to a state socialist production process? At similar levels of the development of the forces of production is the work organization in industrial societies essentially similar, irrespective of differences in their political and economic systems? After undertaking case studies which compare advanced capitalism and state socialism, specifically the United States and Hungary, we have come to the provisional conclusion that the two types of economy do incline toward different forms of work organization. Specifically, Braverman's (1974) thesis that the tendencies toward the separation of conception and execution shape the character of capitalist production finds indirect support from the reverse tendencies we observed in state socialist enterprises.

Criticisms of Braverman have often been misplaced. His focus on domination at the expense of resistance, his mistaking ideology for reality, his recognition of only one strategy of control where a number are operative, his essentialist view of development without adequate analysis of social mechanisms, are all important shortcomings when explaining variations among and within capitalist economies. But Braverman set himself the task of identifying features common to all forms of the capitalist labour process, so his claim that its tendency is toward the separation of conception and execution can be properly evaluated only through a comparison of the labour process in capitalist and non-capitalist societies. This chapter explores the more undeveloped side of this comparison, namely the socialist labour process.

Braverman (1974) was primarily concerned with domination and exploitation, the vertical dimension of production, not with the horizontal conditions that make production possible. That is, Braverman took as unproblematic the supply of inputs to and the demand for products of enterprises. Neither supply nor demand can be taken for granted and we follow Kornai's (1980) distinction between two types of advanced industrial economies, one in which supply exceeds demand, the modern capitalist economy of over-production, and one in which demand exceeds supply, the state socialist economy of shortage. Contrary to Piore and Sabel (1984) who argue that demand-side constraints generate tendencies toward the reunification of conception and execution, we argue that this is the result of supply side constraints.[2] Our task will be to identify, on the one hand, pressures toward and compatibility between expropriation of control from the shop-floor and over-production under advanced capitalism and, on the other hand, pressures toward and compatibility between workshop autonomy and shortages under state socialism.

Theoretical framework

We define a mode of production as composed of two sets of relations: relations of production through which goods and services are appropriated and redistributed, and relations in production which define the labour process, the production of those goods and services. Under capitalism appropriation is private with a view to accumulating profit in a context of market competition. The pressure here is to gain a competitive edge either by process innovation (including reducing wages, developing mass production, reducing inventories and introducing new technology) or by product innovation. This has two consequences. First is the tendency toward over-production, for supply to exceed demand. Captialism is, therefore, characterized by demand constraints and, following Piore and Sabel (1984), one can plot the development of capitalism and its national variations in terms of changes in those constraints as well as the way enterprises and states respond to them.

But there is a second consequence of the search for profit in a competitive market which Piore and Sabel (1984) overlook. That is, it leads to the insecurity of both capital and labour. Profit is realized in the market but generated in production. The reproduction of the relations of production depends first and foremost on the relations in production and so the capitalist can afford the latter little unfettered autonomy, and all the less so the more intense the competition. Although management might subscribe to all sorts of ideologies defending greater participation by employees and in certain cases put these into practice (see Chapter 9) this is concerned with achieving control over and co-operation from employees. The contemporary context of global competition has created pressures toward centralization within large enterprises, for example, through the elimination of middle managers, whilst simultaneously managements are pursuing 'involvement' strategies at 'local levels'.

Since labour depends on capital over which it has little control its fate is doubly insecure. It has to cope with an arbitrary subordination to capital, itself subject to the caprice of the market place. Anxiety at this level concerning material livelihood is inimical to forms of self-organization that do not bring immediate economic gains or may further endanger jobs.

In state socialism, central appropriation incorporates enterprises into a hierarchical bargaining structure.[3] The accumulation of resources, whether of materials or investment, depends on the enterprise's bargaining power with the centre which may depend upon its size, its profitability, the political influence of its director, plan fulfilment or other criteria. None of these are 'hard' criteria but are themselves subject to bargaining. The results are twofold. First, enterprises develop a seemingly inexhaustible appetite for investment resources, leading to shortages. The source of that appetite cannot be reduced to a universal urge for expansion (Kornai, 1980) but more important in our view is the allocation of new resources which makes it impossible to effectively utilize existing ones. Supply constraints, that is, stem from the discrepancy between the logic of allocation and the logic of production.

Central appropriation and redistribution give rise to a second set of consequences. The success of an enterprise is less dependent on the production process than bargaining power with the centre. Insecurity lies in the competitive relations among enterprises for resources which are centrally allocated. The result is a split within management between strategic management, looking upwards to reproduce and expand the relations of production, and operational management concerned with relations in production while middle management negotiates relations between the two. The independence of operational management creates the possibility of autonomous adaptation to supply constraints. As we shall see this autonomy can become quite coercive when materials and machinery are so inadequate as to make adaptation more and more impossible. At the same time employees do not work in fear of losing their jobs – a security which conditions the possibility of their self-organization.

In other words, centralized appropriation – the separation of conception and execution at the level of relations of production – goes hand in hand with decentralized production – the unity of conception and execution at the level of relations in production. This is made possible by guarantees of employment and of enterprise survival while it is made necessary by the need to adapt to shortages. In capitalist appropriation, on the other hand, the mutual interdependence of the relations in production and relations of production leaves no space for autonomous self-regulation of the former without corresponding regulation of the latter. Any attempts at self-organization of work are made more difficult by the insecurities facing both capital and labour as well as by the centralizing pressures from demand-side constraints.

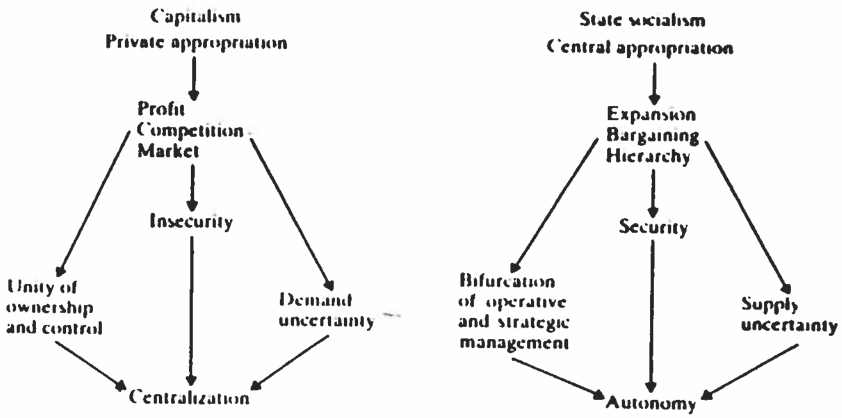

Figure 16.1 Ideal type models of capitalist and state socialist enterprises

In this chapter we illustrate this theoretical framework by an analysis of Red Star Steel Works, one of Hungary's three integrated steel mills. We will examine, in particular, one section of the plant where the steel is actually produced. Here the use of the most modern equipment, imported from advanced capitalist countries, allows us to control for the effects of technology in studying how the political economy shapes work organization. Following the model outlined above, we focus on problems in the supply of both investment resources and material supplies, and how shortages are exacerbated by demand constraints. We then turn to the way a shortage economy structures management. At the enterprise level strategic management negotiates external relations, in particular bargaining with the state over, for example, new investments, subsidies, prices and production profiles. In the plant middle management acts as a co-ordinating umbrella for operational management, the majority of whom are formally skilled workers. Middle management finds its influence restricted, on the one side, by strategic managers who hand down decisions arrived at through accommodations with the state and, on the other side, by operational managers who have to enjoy considerable autonomy if they are to adapt to the exigencies of shortages. We describe the forms of this self-organization on the shop-floor and managerial attempts to undermine it. In particular, we studied two cases of attempted centralization – the use of computers to regulate the system of production and the imposition of a centrally directed system of quality control – and a further case of the scrap yard where shortages were too intense to permit meaningful self-organization. Finally, we draw some

conclusions about the potentialities and tendencies of the socialist labour process.

Shortage constraints at Red Star Steel Works

The problem of shortages becomes more or less intense according to pressures from the demand side and from the character of the technology. We examine each factor in turn.

Demand pressures

Red Star Steel Works produces steel for domestic and foreign industry, including quality carbon and alloy steel. Of Red Star's total steel production in 1985 63 per cent was used domestically, 14 per cent was exported to socialist countries and 23 per cent to the West. The specific site of our study within Red Star was the Combined Steel Works, completed in 1980 at the very height of the international steel crisis. Its purpose was to introduce 'state of the art' technology into the production of quality and alloy steel, primarily to supply the growing need of domestic manufacturing industry for specialized quality steels. Proudly boasting that it can produce any type of steel, Red Star management faces intense pressure from the state to accept orders for almost any type of alloy steel required by Hungarian industry. The relatively small scale of manufacturing ventures and a general unwillingness to use higher quality steel in Hungary has given rise to lots of small-batch production with a wide range of quality specifications.

Diverse and small-batch production is also the result of state economic policy. The construction of the Combined Steel Works was part of a larger government plan for the steel industry, namely that in addition to supplying domestic demand it should export finished products to the dollar markets while importing its raw materials from the ruble markets, complementing the opposite strategy of the machine and vehicle building industries which import capital goods from the West and export to the Soviet bloc. The success of this venture has been substantially thwarted by the unanticipated international crisis in steel production, marked by world steel surpluses, competition from both advanced and industrializing countries with their new steel complexes, and falling prices for finished steel. The strategic management of Red Star has sought to enter into the world market by accepting orders which Western steel makers reject as uneconomic, namely small-batch production of high quality steels at huge losses. Only by establishing its reputation in such steels can Red Star begin to attract orders that might be profitable but to achieve the necessary reliability is virtually impossible given the constraints on small-batch production posed by shortages in and/or poor quality of raw materials and investment goods. A further consequence is that the state has to make up the losses of the steel enterprise with subsidies, leaving no resources for the investments necessary to alleviate some of the problems responsible for the losses.

Uneven development of technology

Irrespective of demand-side pressures Combined Steel Works has to operate in a very unfavourable technological environment. On the one side, the backwardness of the technologies that produce the basic ingredients for steel production – the blast furnaces and scrap deliveries – and, on the other side, the antiquated rolling mills that are often poorly equipped to deal with processing high quality steel undermines the effectiveness of the new steel making complex. While this problem of uneven technology due to under-investment can be found in captalist countries it is accentuated in the shortage economies of state socialism. Here the distribution of investment resources is based on bargaining with state organs, that is, on political as well as economic criteria. Rather than concentrate all new investment at a single steel enterprise it becomes politically imperative to distribute resources among all three enterprises, thereby leading to the development of uneven technology.

To understand some of the problems of installing capitalist technology in a socialist economy we have to look more carefully at the character of that technology. The new steel producing complex gradually replaced the eight, old Siemen's Martin open hearth furnaces with an eighty-ton basic oxygen converter from West Germany, known in the shop as the LD. Like the Martin furnaces before it the LD reduces pig iron to steel by combining it with scrap (roughly in a ratio of four to one) under high temperatures. But whereas the Siemen's Martin furnaces used gas to maintain the necessary high temperatures this is accomplished some eight times as quickly by an infusion of high pressure oxygen. Here operators face a number of typical supply problems. For example, the amount of oxygen 'blown' has to be carefully controlled to produce high quality steel. The computer assumes that the oxygen is 97 per cent pure whereas in fact its purity fluctuates between 87 per cent and 94 per cent so that operators have to blow more oxygen in than prescribed. Exactly how much depends on the quality of the oxygen, which is often unknown. In addition to the LD the combined steel works contains an eighty-ton electric arc furnace from Japan, the UHP, which operates in conjunction with a Swedish vacuum degasser, the ASEA, to provide the highest quality steel.

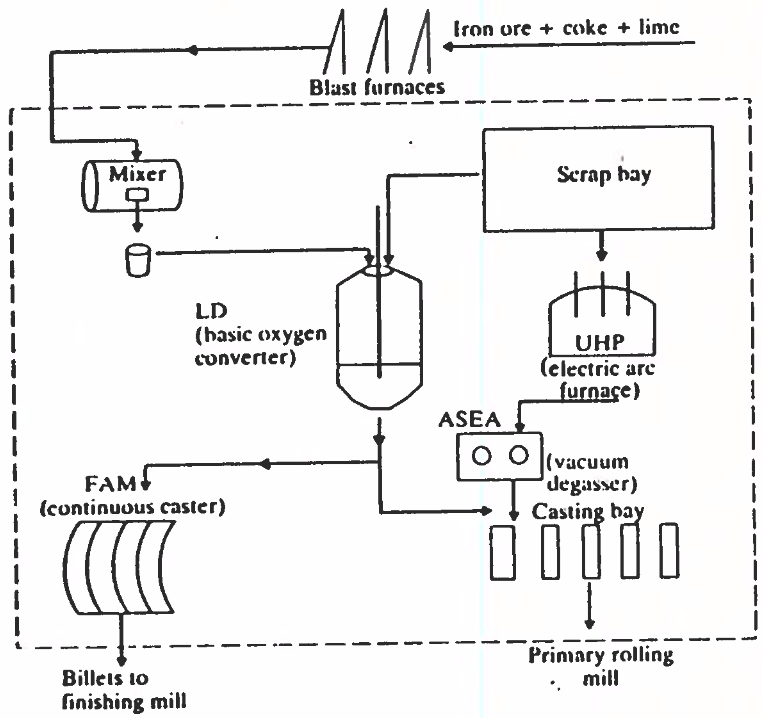

Figure 16.2 The Combined Steel Works at Red Star

Within the same complex are casting facilities. There is a five-strand continuous caster, the FAM, from Japan which accepts steel mainly from the converter. Money did not permit the two continuous casters, originally planned, to process the bulk of the steel produced. Even with the best continuous casters, casting sensitive alloy steel is a difficult operation usually confined to one or two qualities and not the wide range that would have to be cast at Red Star. So there remains a casting bay where ingots are cast and from there taken to the more primitive primary rolling mill via an ill-equipped soaking pit where they are reheated. Stoppages at either of these points affect the casting of ingots at the casting bay as well as the final quality of steel produced in the fine rolling mill. To ensure continuity in production at the rolling mill, that is avoid frequent change of the rollers, they try to maintain the same shape of steel for long periods of time which results in frequent changes in the quality of steel, exacerbating problems in the steel making process.

Pig iron (hot metal) coming from the blast furnaces is *teemed* (poured) into a mixer which can hold up to 1,300 tons, enough for almost twenty *heats* ('vessel' or 'ladle' of steel). As well as acting as a buffer, the mixer is designed to homogenize the content of the hot metal so that steel production in the converter can proceed more smoothly. It is important when the quality of the pig iron from the blast furnace varies considerably over time, as is the case due to the poor and variable quality of the iron ore, the ineffective sinter plant which processes the iron ore, and the now old fashioned blast furnaces. In practice, due to the shortage of pig iron the mixer is often less than half full so that it does not homogenize the composition of the hot metal charged into the converter.

Finally, there is the scrap. As the major ingredient of the electric arc furnace the quality of scrap poses the critical barrier to the production of high quality steel. Scrap is also used in the converter together with pig iron and here too the variable quality means that it is more difficult to control the production process. In an advanced steel mill the scrap is divided up into several grades so that they can be selected according to the steel to be made. Here the scrap is not sorted but heaped onto a single pile. It is often of very poor quality and unprocessed – loose, light and often mixed with slag. There is neither the space nor the equipment for effective processing. The best scrap comes from within the enterprise but most of it is used at other electric arc furnaces.

Tightly-coupled technology

We have seen how surrounding advanced technology with more backward technology intensifies the problems created by shortages. But the character of that advanced technology is itself a source of tension. The different parts of the Combined Steel Works are tightly interconnected and interdependent at the same time that they have their own cycles of production so that the entire operation is very sensitive to mechanical breakdowns and to the availability and quality of raw materials. Take the relationship between the converter (LD) and the continuous caster (FAM). The cycle of production at the FAM dominates the production process at the LD but only within limits defined by the LD's own cycle. Once the FAM begins to cast it must be continuously fed with heats from the converter about every forty-five minutes (the exact time depending on the size of the billets being cast and the number of strands working). To be efficient the FAM must be fed at least five consecutive heats. This requires advanced planning. There must be enough hot metal and scrap for all five heats and the temperature of delivery (around 1,600 degrees) is important otherwise the FAM will not work properly. It can happen that by the time the heat reaches the FAM it is too cold, or it reaches the FAM too late, or something happens at the FAM so that it malfunctions – the strands get clogged up with aluminium coating, steel can leak from the strands due to the presence of bits of slag or it may have too low a viscosity due to low temperature before entering the strands – then the heat has to be sent to the casting bay where it can be cast at lower temperatures. But that is a complicated re-routing process and whether there will be space at the casting bay depends on the availability of ingot molds. Such an elaborate co-ordination in time and space of tightly-coupled technology is very susceptible to the type of supply problems that a socialist firm faces. What are the implications for the organization and direction of work?

The squeeze on middle management

Based on the demarcation of three levels of management – strategic, middle (directing the plant and working on day shift) and operational or shop floor (distinguished by shift work) – our thesis is that the shortage economy tends *de facto* to polarize managerial direction at the lowest and the highest levels, leaving middle management dependent on both. This is a consequence of a shortage economy which requires strategic management to negotiate with the environment, particularly the state, at the same time that responsibility for dealing with shortages must lie in flexible organization on the shop floor. We shall show in later sections how attempts by middle management to appropriate control over the shop floor undermine effective adaptation to the exigencies of a tightly coupled technology in a context of supply uncertainty. This is not to say middle management is superfluous. It does carry out important recognizable functions to which we now turn.

Routine functions

First, middle management performs certain routine functions. The highest levels create a buffer between the actual shop-floor practices and the attempts by the front offices to dictate alternatives. Here the authority of the plant manager is critical – both with those above and those below. He has his agents on the shop-floor, work site managers and foremen working permanently on day shift. They mediate dictates from above, as when some urgent order requires immediate production, an experiment is run or preparations have to be made for the visit of a delegation. They are supposed to plan ahead, for example, the supplies needed at the work stations. They redistribute personnel on a temporary basis when there are shortages as well as controlling promotions and demotions. Foremen and work site managers are responsible for co-ordinating relations among the parts of the plant. In their daily managerial meetings they are held accountable for failures at their work sites. At the same time, we shall argue, steel making in the context of shortages of materials and uneven, tightly coupled technology requires that immediate production decisions be made on the spot by skilled workers who are elevated to what we have called operational managers, specifically the steelmakers at the LD, UHP and ASEA, the casting bay master and the process controller at the FAM.

Development functions

Second, middle managers attempt to improve the efficiency and safety of the plant and during the three years of our research we observed considerable increases in the output of the converter. When we began in 1985, the average number of heats was as low as 6 or 7 per shift; when we left two and a half years later it was as high as 9 or 10 with a maximum of 14. This was made possible by the greater availability of pig iron from the blast furnace and higher quality scrap steel. The crucial factor was the final closure of the remaining four Siemen's Martin furnaces in October 1986, so that all the pig iron could be directed to the converter as well as an improvement in the supply of scrap. But who decided to close down the Martin furnaces? Confronted with the necessity of new investment there, strategic management decided to close them down altogether, exploiting the move as a sign of Red Star's commitment to modernization. Once they were closed many of the advantages to the Combined Steel Works fell into place.

Another achievement of middle management is the increased rollability, that is improvements in the quality of the steel coming from the Combined Steel Works, permitting more efficient production in the rolling mills. It attributes this to improved organization and a new incentive system. Further investigation shows that the improvement in the rollability can be attributed to the improved quality of the casting powder used in the casting of ingots, although here, middle management was involved in obtaining the new material. Finally, in the second quarter of 1987 middle management proudly announced a considerable increase in the number of heats per converter lining, from a record of 861 to 1,294. The major reason appears to have been the use of magnesium oxide which reduces the corrosive effects of the slag. This is a textbook solution to the problem, raising the question why it took so long to be adopted. It seems that the problem became particularly acute when, in a short period of time, the price of the heatproof bricks that make up the lining more than doubled from 6 million forints to 14 million, to be paid in foreign exchange. Strategic management transmitted gradually increasing sensitivity to budget constraints by offering middle managers considerable bonuses for extending the life of the lining. Such innovation bonuses are a major way for middle managers to increase their income but not all innovations receive significant rewards. Here middle managers have to take their cue from strategic management who set the system of rewards. Again the initiative for development lies with top managers. There is a reluctance to take up small-scale changes on the shop-floor which would advance production but offer few material rewards.

Regulatory functions

The third and perhaps the most important function for middle managers is to establish the incentive system for shop-floor operations. While all production workers in the Combined Steel Works releive bonuses according to the performance of their respective sectors, output is beyond the control of all but the key operators, such as the pivotal figure of the steelmaker who directs production at the converter. Given a programme of production of certain types of steel, the steelmaker faces three problems: the first is to obtain hot metal and scrap, that is, backward co-operation; the second to ensure effective production of steel at the converter; and the third to deliver steel which is of appropriate quality and temperature which can be teemed at the FAM or casting bay.

The official incentive system corresponds to these three problems. Thus the steelmaker tries, first, to minimize the percentage of hot metal per ton of steel. This in turn minimizes the cost of inputs, since at Red Star hot metal is more expensive than scrap. Second, he tries to minimize the number of kilograms of charge (hot metal and scrap) per ton of steel produced. This is a measure of the efficiency of the converter. Finally, he tries to maximize the ratio of steel teemed to steel cast. This involves producing steel that is of the right temperature, right quality and right quantity so that it can be used at maximum efficiency at the FAM or casting bay. At the FAM any amount of steel can be cast, so that the steelmaker does not worry about the number of tons; but the temperature is critical. At the casting bay, on the other hand, only fourteen ingots each of 5.8 tons can be cast, that is 81.2 tons. Anything over this will have to be scrapped, bringing down the steelmaker's rate of teeming. Here the operative temperatures are lower because the casting is quicker, giving more flexibility to the caster. As far as the steelmaker is concerned, the quantity of steel cast is critical and therefore the steelmaker develops an interest not just in the provision of hot metal and scrap but also in what happens at the FAM and Casting Bay.

For those whose efforts affect production the official incentive system functions quite well. Sometimes, however, there are breakdowns, most frequently at the FAM, that are beyond the control of the operators but which can adversely affect their pay. On one occasion the personnel officer explained how the FAM had not been working well and workers' wages were being threatened. Extra premiums were introduced to create an effective bottom to their pay – absent in the official pay incentive system. If the official system had operated by itself then the FAM would not work as efficiently as it does, there would be continual turnover of workers and their spontaneous co-operation would be lost. A bargain has to be struck on the shop-floor between workers and managers outside and, indeed, in opposition to the official incentive system.

If this incentive system is the carrot there is also the stick, a punishment system that hung heavily in the minds of operators, arousing fear and fury. In a system so sensitive to shortages, there were ample cases of hold-ups, breakdowns and failures, whether these took the form of production stoppages, production losses or production of scrap. Here the punishment system took its toll. If operators failed to deliver the expected number of heats then, irrespective of the problems they had faced, they were subject to reprimand and verbal harassment. A more serious failure, such as the production of scrap, elicited threats of fines, some of which were actually carried out, for those declared negligent. Any failure to meet expectations, any malfunctioning has its culprit who must be punished. The punishment system is ritualized in the morning meeting the plant managers hold with night shift operators, known to all, after the TV talent show, 'Who knows how to (defend himself)?' Each operator has to give a persuasive account of any production failures. Later on there is a meeting of the day shift managers where fines and reprimands are sometimes distributed. Those who run the meeting are not particularly interested in excuses or explanations, but rather are concerned to allocate the blame to some irresponsible action.

Managers responsible for implementing this punishment system say it is necessary because the steel works is such a dangerous place. This is less than an adequate response since danger is often the stimulus to self-organization and autonomy. Another explanation lies in the seemingly crucial role the Combined Steel Works plays in the overall profitability of Red Star but in a system of such tight interdependence the role of the blast furnaces and the rolling mills are no less crucial. More likely is the view that strategic management is no less interested in the complaints and excuses of plant management than the latter is in those of its operational managers. The punitive system is passed down from above. Further, the unwillingness of plant managers to examine the causes of failures lies in their lack of control over the crucial factors of production (supplies and machinery) and their dependence on shop-floor operators to deal with breakdowns, disruptions and crises as they spontaneously develop on the shop-floor. The punitive system represents a frustration with their own powerlessness. What then is the response to this system of positive and negative sanctions on the shop-floor?

Self-organization on the shop-floor

Given the constraints under which Red Star has to operate, it is perhaps remarkable that its productive system is as effective as it is. As we will argue, its success can be largely attributed to the adaptive responses of operators on the shop-floor. What are the elements of their autonomy?

Lateral co-operation

On the basis of criteria established from above, shop-floor management's attention is directed laterally toward co-operation with other units in the Combined Steel Works. Take the steelmaker at the LD, like most of the other operators always a male. Since he is dependent on the co-operation of others he must command the confidence of his fellow operational managers at the other work sites. We observed the strivings of a recently promoted and inexperienced steelmaker to establish himself among his peers, his furnacemen and middle managers. Whenever he made a mistake, for example, they would say how young he was, how much he had to learn and how in the old days the steelmakers were really experienced. The steelmaker who does not command respect may find himself waiting for the teeming ladles, for the 'pots' into which the slag is poured, for hot metal from the mixer, for scrap from the scrap bay, for space and ingots to be prepared in the casting bay. Co-operation is particularly crucial when steel is being made for the FAM since its operation requires an uninterrupted flow of heats from the converter. The steelmaker's adrenalin begins to run and tempers can flare. If operators at the other work sites are not keen to co-operate he has to somehow persuade them that it is in their interest to do so.

But the steelmaker seeks more than simply co-operation from others. In order to protect himself against unforeseen adversity, such as breakdowns at other units, poor service from the overhead cranes which often need repair, inferior quality or inadequate supply of materials, arbitrary interference by higher managers, he asks them to undertake two types of manipulations: routine manipulations that make his production record look good and exceptional manipulations to cover up mistakes. First, the amount of scrap and hot metal registered as charged into the converter can be made less than that actually charged, so that at the FAM the amount of steel produced gives a better charging rate – ratio of scrap and hot metal to steel produced. At the casting bay the extra steel gives the leeway necessary to guarantee minimum production of 81.2 tons and if the casting bay master co-operates there will not be too much officially recorded excess. Such manipulations require the co-operation of crane drivers, supervisors at the casting bay, scrap yard, mixer and FAM.[4]

The second set of manipulations take place when there is a failure at the converter. For example if the chemical composition of the heat is outside the limits stipulated for the steel being made, it is possible to change the steel being produced to a different type. This requires the co-operation of the dispatcher – another operational manager – who plans production of steel from blast furnace to rolling mill during the shift. The steelmaker may ask the FAM to accept a heat that is slightly cooler than prescribed. Or he may ask the casting bay master to discount the scrap that was produced from a heat, or ask the FAM to submit a sample from a good piece of steel rather than from the bad one actually produced. In his turn the steelmaker can extend favours to those upon whom he depends. He can record lost time due to shortage of scrap, for example, which otherwise would be blamed on the scrap master as time lost due to shortage of hot metal, for which no one is blamed if there is less than 600 tons in the mixer because officially this is the minimum. In practice there usually is less than 600 tons so that such a doctoring of the record is easy. In short, a system of reciprocal favours develops around the objective of producing steel on the one side and the protection of operational management from the punitive sanctions of middle management on the other.

Any attempt by management to eliminate such manipulations would lead to narrow self-protection on the part of each work site, involving continual and heated arguments as to who was responsible for a given failure, for example, in teeming. As it is the manipulations are the basis of joint co-operation. The steelmaker accepts the risk involved; for example, that his teeming ratio (amount teemed to amount of steel produced) may be adversely affected by what happens at the casting bay or the FAM but in return he expects his counterparts to undertake compensating manipulations that will make his production record look good and cover up his mistakes. Instead of interfering directly the plant manager allocates fines to those held responsible for lapses. Operators and steelmakers do not forget their punishments in a hurry – not only because the fines are considerable but also because of the public humiliation. In this way middle management defines what is acceptable and what is not. Out of this emerges the norms that govern relations and practices on the shop-floor in conditions of uncertain production.

Shop-floor culture

This shop-floor culture is further elaborated through a network of social ties. While drinking groups forge solidarity between operators and their team of workers, football competitions and outings, all of which are organized on a plant-wide but shift-specific basis, establish ties between the different work points. Although workers and operators may move around from work place to work place they rarely change shifts. This facilitates the development of social ties and a common set of norms. It is interesting to note, therefore, that the majority of complaints are made against those who are outside the control of this system of co-operation, that is, against the laboratory and maintenance workers. Both groups are outside the moral order of steel production and their co-operation is more difficult to extract.

Shifts compete with each other to teem the greatest number of heats and to avoid breakdowns. This leads to antagonisms as each shift tries to push problems onto the next shift. One shift may postpone repairing the tap hole which has become too large or spraying the inner wall of the converter that has worn thin. Rules about the relative composition between hot metal and scrap may be flouted to get out a last heat, thereby emptying the mixer of hot metal and leaving the next shift stranded. At the casting bay there might be no ingot moulds or the place may be left in a mess, at the scrap yard the new crane drivers must begin afresh with empty boxes, or there may not be any pre-heated ladles or slag dishes. Any of these can lead to considerable time loss at the beginning of a shift. Moreover, the quarterly production conferences are held separately for the different shifts. All of which cements solidarity within a shift across work points while building up distance between workers at the same work points but on different shifts. While middle management complains about 'shift chauvinism', at the same time its own punitive order encourages lateral co-operation among work sites at the expense of co-operation between successive shifts.

Obstacles to centralization

So far we have argued that adaptation to supply constraints is most effectively accomplished through granting autonomy to operative managers on the shop floor. This becomes even clearer when we examine attempts at centralization.

Computer control

Let us return to the steelmaker at the LD and his assistant who control production at the converter. So far we have talked about how they negotiate relations with other work sites but what happens at the LD itself? They have to decide first how much hot metal and scrap, and then how much fluorspar and lime have to be charged into the converter and finally the quantity of different alloys to be charged into the ladle prior to or during the tapping. They are also responsible for the length of the oxygen blow, that is the volume and the number of blows of oxygen. The converter, like all the other work points in the Combined Steel Works, is equipped with computer-directed operations, so that for any steel on the programme there are instructions as to how the steel should be made.

Given a specific steel to be produced the computer calculates how much scrap and hot metal have to be put into the converter and based on the average composition (in terms of carbon, silicon and manganese) of the last ten heats of hot metal gives up a prescription for the volume of oxygen to be blown in. Where indeed the average composition of the last ten heats of hot metal would predict the composition of the eleventh, and where other factors are held constant the prescription would be an accurate one. In practice this is almost never the case. Often the mixer is nearly empty and so does not perform its homogenizing role, and the hot metal from the blast furnace can be of very uneven quality. This is the first major variation which the computer cannot take into account. The scrap itself is not sorted so that it can vary in content. Then there are a wide range of miscellaneous problems that affect the length of the oxygen blow: the purity of the oxygen, the temperature of the ladle into which the steel is tapped, whether the steel is going to the FAM or to the casting bay, the temperature of the hot metal (pig iron), the size of the tap hole and whether the argon equipment which circulates the steel once it is made is working. The computer cannot take these and other imponderables into account so they have to be assessed by the operator.

The computer is not only unreliable but, in roughly 40 per cent of the heats, fails to give any prescription at all for the oxygen blow. This is usually because the acceptable limits of silicon or of manganese in the hot metal are exceeded, so that their oxidation generates either too much or too little heat. In practice the steelmaker has no such option – not to make a heat when the conditions are not within prescribed limits – so he figures out an appropriate oxygen blow. On one occasion, however, we heard that the production manager had halted the delivery of hot metal from the blast furnace because the silicon level was considerably above that prescribed. Only the top levels of middle management can intervene in such a manner.

That these problems are largely distinctive to a shortage economy was illustrated when the Japanese who installed the computer were recalled because it was not living up to its promise. The programme could not take into account the long stoppages due to malfunctioning of equipment or shortages. At first the Japanese were quite baffled by the problems encountered in the plant. They then tried to reprogramme the system to meet the specific needs of a shortage economy. But it still does not dictate operations and so its use is confined to information processing.

It is not simply a source of information but actually saves a great deal of time by recording the processes of steel production. But even here it

is not always accurate. The shortage economy and the incentive system lead to manipulations that the computer does not register and so many of the data are misleading. When one of us asked a manager if we could examine the computer readings on the amount of hot metal in the mixer, he told us we should not bother since they are hopelessly wrong, registering some 2,000 tons! The computer system was originally set up so that operators could not change any of the data on the screen. But this proved incompatible with the exigencies of a shortage economy so that now there is a woman in the production department who is responsible for 'correcting' the data in the computer in accordance with shop-floor manipulations. But anyone who wants to make any changes has to first register that request in a special log book.

The following incident highlights the conflicts that can arise over the proper use of the computer. One Saturday morning, the chief metallurgist came in to inspect the production of a very special steel (because of the high cost of the alloys and the importance of the quality of the product). The problem with this steel is that it requires very low phosphorus and sulphur contents at the same time as a high carbon content. This is difficult to achieve because the conditions for getting rid of phosphorus and sulphur also reduce the carbon level. There is a special de-sulphurizer but this still sometimes leaves the sulphur content too high. To further reduce it requires a very high temperature, but if it is too high the phosphorus which has been eliminated through oxidation and passed into the slag is de-oxidized and returns to the steel. The operation is a delicate one in which, rather than a single blow of oxygen, it is necessary to give two blows keeping the temperature relatively low and pouring in lime and fluorspar to help oxidize the sulphur and phosphorus, thus removing them to the slag. Seeing the operator working to keep the temperature relatively low the chief metallurgist told him he was doing it all wrong and that he should work according to the programme which stipulated a long single oxygen blow. The operator knew that this would not work and took no notice even as the chief metallurgist stood there.

The conclusions are twofold: any attempts to use the computer system as a means of control are doomed to failure because of the uncertainties, mainly from the supply side; and any attempt at the centralization of control in the hands of those who are not attuned to the day-to-day realities of the Combined Steel Works easily leads to the production of scrap. Although middle management does make such attempts at expropriation of control, they accept for the most part the necessity of workshop autonomy.

Quality control

We have shown how shop-floor autonomy helps adjustment to shortages, particularly in the context of tightly coupled work processes. But it cannot be forgotten that shortages exist only relative to demand constraints, so that as the latter become more severe the former also intensify. This can be seen in the case of quality control.

The second half of the 1970s saw government economic policy for the steel industry turn toward the provision of Hungary's developing manufacturing industry and the expansion of the export of steel to the West. In line with this strategy Red Star proposed that the Combined Steel Works increase and improve the production of its quality and alloy steels. In 1983, two years after the completion of the new complex, it exported 1,500 tons of alloy steel, in 1984 about 50,000 and in 1985 62,000. Most of these steels were produced in the Combined Steel Works but with great scrap costs. Scrap rates have varied from 5 per cent to 40 per cent according to the type of steel. In 1986, for every 1,000 tons of finished steel, 1,400 tons of liquid steel had to be produced.

The difficulties of making quality steels underline the dilemmas of production in a shortage economy. Here the diagnosis and solutions of American experts, brought in to advise the Red Star management but accustomed to problems of a demand-constrained economy, illuminate the distinctive dilemmas of socialist production.[5] The experts attributed increasing rates of scrap to declining effort and a diminishing sense of responsibility. As a solution they proposed the creation of an independent and centralized system of quality control which, through computerization, would trace each heat of steel through its various production processes, pinpointing the source of defective quality, making it possible to correct the problem and immediately halting the continued processing of substandard steel. In theory their proposal was admirable but it did not come to grips with the underlying realities of the uncertain production conditions, be it unreliable machinery or inadequate, or even absent, materials. It was never really implemented.

Frustrated by their apparent powerlessness to affect the quality of production, middle managers in quality control have attempted to follow these plans for centralization.[6] But instead of using surveillance to identify sources of scrap production they have used it to punish those they find culpable of mistakes. This has the unintended effect that inspectors on the shop floor often turn a blind eye to the attempts of operators to push defective steel onto the next work point. They naturally sympathize with the operators' attempts to escape responsibility for what is not of their own doing, whether it be that steel arrives at their work place already defective or working conditions make sub-standard steel unavoidable, that is if it is to be produced at all. The inspectors do not want to be party to punishing workers for mistakes they either did not make or were forced to make. In short, rather than solving the problem the punitive system exacerbates it.

There is, for example, a continual struggle between the primary rolling mill and the Combined Steel Works as to who is responsible for steel that cannot be rolled. The rolling mill blames the steel producers for not turning out steel according to specifications or for uneven surface on the ingots, while the Combined Steel Works blames the rolling mill for mistakes in reheating the ingots or poor rolling practices. Because of antiquated reheating equipment and poor measuring devices and because of the sensitivity of quality steel to rolling practices it is hard to distribute responsibility fairly. The difficulty of discovering the source of the problem is only exacerbated by the application of punitive sanctions, leading each side to cover up its own mistakes and spy on the other. Although the root cause of quality failures lies outside the control of operators, the correction of that which does lie within their control requires immediate co-operation between inspectors and producers. This will only take place in the absence of punitive and arbitrary interventions by middle managers. Centralization of quality control is another exception which proves the rule that technically efficient production depends on autonomous organization at the work place.

Scrap bay

Unaccustomed to the problem of shortages the American experts had nothing to say about attempting to change critical supply conditions, in particular the situation at the scrap yard. Supply uncertainties here are so extreme that no amount of shop-floor autonomy can facilitate adjustment. The history of the scrap bay illustrates well the character and sources of shortage in a socialist economy.

When the Combined Steel Works was being planned the government told the Red Star management that it would provide no more than 10 billion forints to finance the project. The original estimate was 12 billion forints so top management had to decide on cuts. The essential technology had to remain, they argued, and instead reductions should be at the expense of some peripheral part of the plant. Accordingly, in order to reduce the size and therefore the cost of the scrap bay, management inflated figures for the density of scrap they would be receiving. They estimated that the scrap density would be between 1.4 and 1.8 tons per cubic metre whereas the real figure should have been between 0.6 and 0.8 tons. In this way they pushed the responsibility for higher density scrap onto the enterprise which collects and distributes scrap. This higher density, they knew, would only be possible if there were to be capital investment in scrap processing equipment – a very unlikely event. So the scrap bay was built much too small for the voluminous loose scrap and as a result it is impossible to sort the scrap into different grades, as is done in capitalist steel plants. Instead it is simply dumped into one huge disorganized mound. From there the scrap master has to organize deliveries to the UHP and the converter. Both sets of demands are usually urgent, but the cranes are slow in collecting the scrap because they were designed to gather much heavier types. Moreover, when quality steel is being produced it is critical to know the alloy content of the scrap, yet with only a small electronic device at their disposal such a sorting operation is beyond the capability of the work crew.

The consequences are obvious. The scrap master and his work crew have a great deal of autonomy but little control over their work. They are cynical, frustrated and feel the hopelessness of their task. Here autonomy is antithetical to efficient production because the shortages are simply too great in relation to production needs. The original attempt to save on what appeared to be a peripheral operation becomes a major obstacle to the production of quality steel for which the Combined Steel Works was explicitly designed.

Conclusion

We have opposed the common argument that modern technology requires the return of control to the shop-floor. Technology by itself is not determinant: its effective deployment, in particular the most effective work organization, depends on the form of the wider political economy. We highlighted the link between a centralized economy and the character of work organization in a state socialist enterprise using the most up-to-date capitalist techology. More importantly we took issue with another variant of the reskilling argument: the prognosis of Piore and Sabel (1984), that the future of capitalist society heralds increased worker control over production through flexible specialization. They do not argue from technological determinism but give precedence to market factors: the need to cater to a multi-faceted consumer demand. On the basis of what we know about the mini-mills and integrated steel plants in the United States demand pressures lead to centralization and coercive managerial strategies rather than, as Piore and Sabel claim, the resurrection of the craft paradigm (Barnett and Crandall, 1986; Prechel, 1986).

Our own case study suggests that it is in state socialism, where supply constraints are the more significant force shaping development, that some form of shop-floor self-organization holds the greatest potential.[7] Fluctuations in the quality and availability of raw materials, machinery and labour power require some form of autonomous and flexible workshop organization for technical efficiency. We have seen how, on the one hand, there developed dual systems of management and of incentives. In order to adapt to supply constraints in the context of tightly interdependent work sites, shop-floor management had to be given the room to make decisions spontaneously and elaborate a set of plant norms that governed lateral co-ordination. The centrally controlled computer system was mainly useful as a source of information, not as a means of prescription for which it was originally intended. On the other hand, when middle management sought to interfere in the direction of day-to-day operations, crises and work stoppages were a frequent result.

Shop-floor autonomy need not necessarily revolve around a few key figures who direct production. In some situations, such as the machine shop we studied at Banki (Burawoy and Lukács, 1985), workers themselves became the central figures in organizing work. Managers were fewer and acted as the emissaries or agents of workers. At Red Star, on the other hand, the character of the technology and tightly-coupled production involved key leaders at the different work sites, who work out deals among themselves, develop social ties and a sense of joint responsibility. The workers under them undertake a multiplicity of tasks, and in this sense they engage in a form of flexible specialization, but they do not exercise any guiding control over the process of production. Instead they are its agents.[8] This chapter claims that the promotion of technical efficiency, that is the realization of a firm's production possibilities, requires centralization in advanced capitalism and shop-floor autonomy in state socialism. How then do we explain cases of shop-floor autonomy in advanced capitalism and centralization in state socialism?

National economies are constrained not simply by demand or supply, but also by some combination of the two. First, and most simply, within capitalism, shop-floor autonomy springs up precisely where factors of production cannot be controlled, for example in the construction industry or coal mining, just as within state socialism pressures for centralization are most intense where there are stringent demand constraints, for example in military production. Second, supply constraints may become more critical in capitalist societies as profitability becomes less salient. Within a large corporation, divisions may be bound into a political centre much as socialist enterprises are bound to the state, leading to insatiable investment demands and shortages. On the other hand, market competition may develop among divisions within a socialist enterprise so that demand rather than supply becomes the salient constraint.

Third, and even more generally, too categorical a distinction between supply-constrained and demand-constrained economies tends to overlook the mutual determination of supply and demand. That is to say, the more specific and variable the demand the more significant becomes any variation in the quality and availability of factors of production. In as much as the intensification of demand constraints leads to supply problems so shop-floor autonomy may emerge under capitalism. Equally under socialism shortages may so adversely affect the quality of the product that the enterprise will find difficulty selling it and thereby invite centralization.

We can also explain counter-tendencies to our model in terms of worker resistance. In advanced capitalism workers have sometimes successfully resisted the expropriation of skill or centralization of control, just as in state socialism shop-floor operators and workers are often defenceless against the concerted efforts of trade union, party and management to control production. While such economic and social factors explain variations both over time and between places within advanced capitalism and within state socialism, in no way do such variations refute the contention of this chapter that for the survival of these societies the tendencies must be stronger than the counter-tendencies.

Finally we don't want our conclusion to be misunderstood. We are not saying that autonomy on the shop-floor will by itself resolve the dilemmas of socialist economies. Their fate hangs elsewhere, in the hierarchical relations between state and enterprises – relations which create the very problems to which self-organization is one adaptive response.

Notes

Chapter 1 The transformation of work?

1. It is important not to make the mistake of assuming that all writings on flexibility or which emphasize the higher skills and demands resulting from new technologies or managerial concepts are proponents of the flexible specialization thesis. There is also considerable variation amongst writers who accept we are entering a new 'flexible' era. Kern and Schuman, for example, differ from Piore and Sabel (or at least the extreme version of their Second Divide thesis): they do not appear to be so ready to predict an end of assembly work (although they do talk of the end of mass production), but simply of modifications of it, and they stress the extent to which not all workers will gain from the new concepts as there may be increased segmentation in the labour market. Sorge and Streeck (1988), whilst in many ways falling within the broad flexible specialization theory, do give more emphasis to the possible diversity between firms and mediations between technology and outcomes, and prefer the term customized quality production than flexible specialization to denote the new production regime built on reaping increasing returns to scope. For examples of work which focus on flexibility which do not fall in the flexible specialization genre see Jones (1985b, 1986), Libetta (1988), and some of the work dealt with, particularly towards the end, in the overview of German literature by Hoos (1986).

   Whilst there is some variation among both flexible specialization and labour process writers, which complicates definition, in the case of labour process theory there is the added complication that there emerged in the late 1970s what some have called the labour process debate. Initially one of its concerns was the rather deterministic nature of Braverman's deskilling theory, and the importance of worker resistance and negotiation in the work organization. There thus followed a stress by some on the negotiated nature of task structures. Especially in continental Europe this 'negotiated order' approach was increasingly taken to be the labour process approach. Yet others might use it to refer to all parties within the labour process debate, that is assuming they are not hostile to the whole enterprise. The term will be used throughout this book in the more restricted way to more or less equate it with what Lazonick (1983) calls the orthodox Marxist approach to work organization, that is the approach which places workforce control at the centre of the organizational problem and predicts a progressive deskilling as the labour process is increasingly constructed through Taylorist scientific management.
2. For overviews and important contributions to the labour process debate, see Burawoy (1979); Cressey and MacInnes (1980); Edwards (1979); Elger (1982); Kelly and Wood (1984); Littler (1982); Manwaring and Wood (1985); Thompson (1983); Wood (1982).

Chapter 15: Work organization and product change in the service sector: the case of the UK National Health Service

1. For example, Rajan and Pearson (eds) (1986) forecast a net increase in service industry employment in the UK by 1990, with financial, business, and leisure services (hotels and catering, recreation and cultural services) growing the fastest.
2. For accounts of the history of the organizational changes and controversies in the National Health Service (NHS) in the 1980s, see Cousins (1986) and Ham (1985).
3. An account of the NHS's policies for the utilization of information technologies can be found in Scrivens (1985); the take-up of computers in the NHS can be followed in issues of the *British Journal of Healthcare Computing* and in the weekly *Health Service Journal:* see the supplement on 'Health Service Computing' in the issue of 18 June 1987.
4. The European market for portable (or ambulatory) diagnostic equipment was $31 million in 1984; for blood pressure monitoring devices it was $24 million; see Frost and Sullivan (1985).
5. The new tests are the product of numerous technological innovations of the past fifteen years. There have been innovations in solid state chemistry which allow the routine production of multiple layers of thin paper and plasticized films impregnated with tiny quantities of reagents and enzymes. These biochemicals are activated when wet with a blood or urine sample and undergo a colour change which can be detected either visually or with an electronic device. These devices have themselves been transformed by micro-electronics and the miniaturization of computer technologies of the past ten years. Diabetics, for example, can now automatically record in a computerized glucose strip-reader the results of over 300 daily tests performed by themselves. The device can present the results in a variety of graphical forms on a colour monitor for interpretation by the diabetic's doctor.
6. Fischer *et al.* (1984) takes up 300 pages listing the tests that individual doctors in the USA can do in their own 'office laboratories'.

Chapter 16: What is socialist about socialist production? Autonomy and control in a Hungarian steel mill

1. This study is based on collaborative field work at Red Star Steel Works where Burawoy worked as a converter furnaceman for six months in 1985, six weeks in 1986 and two months in 1987. Lukács spent several weeks interviewing management during the same periods. As well as workers and managers at Red Star, we should also like to thank Linda Blum, Wlodzimierz Brus, Peter Galasi, Edward Hewett, Pierrette Hondagneu, Michael Liu, Brian Powers, Vicki Smith, Stephen Wood and Rob Wrenn for their comments and Laszlo Csch-Szombathy for all his help. Burawoy's research was supported by a grant from the National Science Foundation, and a research assistantship from the Institute of Industrial Relations, University of California, Berkeley. Lukács' research was supported by the Institute of Economic Planning, Budapest, the Hungarian Academy of Sciences and the American Council of Learned Societies.
2. It is not surprising, therefore, that capitalist firms facing demand side fluctuations turn to more effective control of supplies, as in the Japanese 'just-in-time' system (Sayer, 1985b; Schonberger, 1982), since these mechanisms establish the conditions under which the greatest centralization of control can occur.
3. Here we have been influenced greatly by the work of Szelenyi (1982) on the character of central appropriation, by the work of Bauer (1978) on plan bargaining and by the work of Kornai (1980) on the shortage economy. While we accept Kornai's criticism of equilibrium theory and his description of capitalism and socialism, as respectively, suction and shortage economies, we find his explanation of the differences inadequate. Focusing on hard and soft budget constraints obscures precisely the contributions of Szelenyi and Bauer, namely the importance of the logics of appropriation and distribution in the two systems.
4. Originally the scrap yard was fitted out with a computer system which would automatically register the amount of both heavy and light scrap charged. The idea was that the front end of the car that delivers the scrap would be filled with light scrap to cushion the impact of the heavy scrap at the rear when both hit the converter walls. In this way the converter would have a longer life. But shortage of scrap and of time, particularly due to programme changes when the amount of scrap would be changed abruptly, made this sorting out process infeasible. So the computer control system does not work, all scrap is registered manually and therefore easily subject to manipulation. Similar manipulations take place in the case of the hot metal. The crane driver is responsible for registering the amount of hot metal. He can turn his counter to zero after there are already a few tons of hot metal in the ladle.
5. These experts came from a consulting firm linked to one of the biggest United States steel corporations. They had been sent to Red Star at the insistence of the Ministry of Industry as part of the World Bank's loan conditions.
6. The careful following of heats from the point of steel production to their departure from the factory as finished steel is still not possible. We found it impossible to trace what happened to a given heat after it left the Combined Steel Works. Part of the problem is that because there are so many different steels being produced, parts of the same heat may end up in different places. Another problem, we were told, is that the storage yard contains so many types of steel that it would be virtually impossible to locate a particular heat. And then there does not seem to be a careful recording of steel that is scrapped and returned to production.
7. Of course, there is the important proviso that self-organization is ineffective and perhaps counter-productive in the context of intense shortages, most likely to occur in peripheral sectors of state socialist economies or in the early period of taut planning in the Soviet Union (Andrle, 1985). But as state socialism develops and the problem of shortages, while remaining, becomes less severe so self-organization becomes a possible solution to increase technical efficiency.

8. Here one might also refer to the emergence of worker collectives which are essentially internal subcontracting systems made up of self-selected, self-organized groups of workers and managers paid for the completion of specific tasks. Collectives can be found at Red Star but in declining numbers. In a fascinating article Stark (1986) underlines their simulation of rudimentary markets adapted to uncertainties generated in bureaucratic environments whereas we regard them as signifying the requirements of self-organization on the shop-floor.

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