THE CONTROL OF TECHNOLOGICAL CHANGE IN THE MOTOR INDUSTRY : A CASE STUDY

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VOLUME TWO

SECTION THREE

TECHNOLOGICAL CHANGE AT LONGBRIDGE

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CHAPTER SIX

NEW TECHNOLOGY AT LONGBRIDGE

Introduction

"A simple but common reason for a particular investment is that it has become necessary for the survival of the firm." - C.F.Carter and B.R.Williams (1)

As we described in Chapter Four,a major element in the Ryder strategy for BL was the decision to develop and manufacture a small-car replacement for the Mini.The importance of this new model - initially the AD088,later the Metro - was doubly emphasized by the role that it was to play as the basis for re-furbishing and modernizing the now largely out-dated Longbridge facilities.Moreover,the organization of production for the new car pursued another element of Ryder's policy - namely,that there should be rationalization "to bring together body assembly processes,so that individual plants are associated with one or more model lines from receipt of..panels to final assembly" (2).As a result,production of the new car was planned to be heavily concentrated and integrated within the Longbridge site itself.(3)

While the related plant-AD088 decisions had many

important consequences for the whole of Longbridge, the AD088 programme was to have its greatest impact upon the 'Body In White' (BIW) area of the plant. The existing BIW facilities in Longbridge's West Works, though still in use for the Mini and Allegro models, were too small and too decrepit to accept a new model. As an internal management report noted ;

> "The W.Works body build plant was erected 50 years ago and is not capable of taking a new model due to the buildings being extremely congested, not suitable for modern BIW assembly, with the building fabrics in poor condition, with wooden roof structure. Further, the building is on 3 levels, environmental conditions extremely poor, with inadequate services and facilities." (4)

This fairly damning report indicates that one of the most important reasons for the replacement of the existing BIW area was the simple fact that due to years of under-investment it was so obsolete as to be beyond consideration for a new model. Given that in Ryder's plans for BL the AD088 was to be the high volume, high quality basis for reconstruction of the firm's model range, the case for the construction of a new BIW plant was well-established. Taking these factors into account, BL management eventually opted to solve the AD088 BIW problems by constructing a new BIW factory alongside the old West Works. In the vast floor-space (750,000 sq.ft.) of the 'New West' all the various sub-processes of BIW manufacture could be efficiently integrated, and there would be extensive opportunities for mechanization.

Technology choice : BIW plant

While the need to construct the New West factory was strikingly apparent, the decisions on which technologies to install in the plant presented management with more problems. In essence, the BIW engineers who undertook this task began their operations with only a very general set of objectives for guidance. These strategic objectives for design can be summarized as follows ;

- To manufacture the AD088, a model with a 10+ years life-span and no BIW 'derivatives'.
- To produce the car at volumes of 6500 BU (Built Up) bodies per week, plus 1400 KD (Knocked Down, i.e. kit form) per week.
- To manufacture at competitive levels of productivity (5).
- To manufacture at an improved level of quality.

The attempt to translate these basic 'parameters' into the elaborate detail of production systems involved the engineers in developing and applying a number of decision criteria. Insofar as any simple characterization can do justice to what was necessarily a very complex decision-making process, the available interview and documentary material suggests that these criteria can usefully be treated as a hierarchy made up of three major categories ; Market criteria, Socio-technical criteria, Technical criteria.

a) Market criteria

The overriding considerations in the BIW design process were derived from the overall marketing strategy for the AD088.The details of this strategy and the rationale behind the AD088 itself have been touched on elsewhere.It is worth noting,however,that apart from providing the original stimulus for the Longbridge investment,the marketing aspects of the new car found further expression as two major criteria within BIW design.The first of these was the question of production volumes ; any production system chosen for the new plant had to be capable of achieving the forecast manufacturing output for the AD088.Secondly,and of equal importance given the market segment at which the AD088 was aimed,there was the pre-eminent issue of labour productivity ; again,any system installed in the New West had to be capable of offering the high productivity standards which were demanded.

These strategic criteria proved,not surprisingly,to be paramount considerations in the choice of technologies for the New West,,Moreover,as each sub-process came up for consideration,the basic combination of the plant's output and productivity parameters served as the most frequent and the most conclusive argument in favour of mechanization.In effect,as the BIW engineers quickly discovered in their evaluations,only a highly capital-

intensive BIW process could offer the high volume and high productivity features which the Ryder strategy demanded.

But it was not only at this general level that the Market criteria had an influence upon design.They also proved to be a significant factor in the BIW engineers' decisions on a major sub-process within the plant.This was the 'body-framing' process,the technically critical and central area where the various sub-assemblies of the body are spot-welded into a complete body-shell. Of all the BIW sub-processes 'body-framing',which is illustrated in Figure One,was viewed as the most important - in effect the technical core of the process - and as a result the choice of 'body-framing' technologies consumed much the greatest share of the engineers' attention and concern.As an illustration of the way in which Market criteria were applied to this crucial sub-process,Table One summarizes the arguments both pro and contra the various technical options.The options themselves are described and defined in Table Nine at the end of the chapter.

TABLE ONE

Market criteria and the 'body-framing' process

	ADVANTAGES	DISADVANTAGES
A.B.F.(I) :		Given robots' longer cycle time for welding, would need 3 rather than 2 'modules' to achieve required volume. (6)
A.B.F.(III):	High volume and high productivity system. "Tooling proposals.. reflect efforts made to maximize automation opportunities,and reduce direct man-hours per car to the lowest level."(7)	
Gateline :		High manning levels. Could not produce required volumes without multiple facilities. Being superseded by more advanced methods, phased out by General Motors.(8)
Eurobuck :		Higher manning than A.B.F. method - retains labour-intensive manual re-spot line.Could not offer required volumes. (9)
Static :		A low volume method, dating from 1950's. Higher volume would "normally be achieved by the installation of a large number of box-jig systems,often located in a number of different manufacturing plants for a single car line" (10) (The AD016 built in this way at Swindon, Castle Bromwich and Longbridge)

b) Socio-technical criteria

The basic guidelines for BIW design were established by the Market criteria - in particular, as Table One indicates, they established a strong argument for the adoption of the Auto Body Framing (III) option. However, it would be misleading to suggest that these abstract parameters of output and productivity were the only important influence upon the design process. Although the BIW engineers were primarily concerned with the achievement of these well-defined economic objectives, an ever-present factor in their calculations was the need to develop and choose technologies that were compatible with the social constraints imposed by the Longbridge site itself. The major such problem of 'interfacing' the technology with the work-force was the result of a basic lack of experience and skill in operating advanced technologies on the part of the production and maintenance functions at the plant. Given that BL's most recent BIW investment at Longbridge had been the installation of an unsophisticated and labour-intensive 'Butterfly Gateline' for the Allegro model in 1972-73, this deficiency was hardly surprising.

Indeed, the legacy of the many years of under-investment meant that the whole social and task infrastructure at the plant was geared to process technologies that were ten and in some cases twenty years out of date. As a result, while major producers such as Fiat had

been developing and installing mechanized and automated BIW systems for the previous twenty years or more,BL in contrast,having little substantial investment in this area and minimal contact with new BIW technologies, had benefitted very little from any technical 'learning curve'.As Appendix Three illustrates in much greater detail,BL's retarded technological development meant that both management and workers at Longbridge were much less well-equipped than Fiat to cope with the problems posed by automated BIW processes.

The most significant of such problems and the greatest social constraint on the design of the New West BIW plant was the lack of relevant maintenance expertise within the Longbridge site (11).The BIW engineers were only too aware that their plans for automation and high volume production would count for nothing unless management could develop a well-organized and highly trained maintenance function in the new factory.As the management 'Red Book' report noted : "To obtain maximum benefit from the capital investment the company must undertake responsibility for an effective planned maintenance system." (12)

Management's concern with the problems of maintaining and operating the new technologies found a recurring echo in the design process itself.An acute awareness of BL's lack of the appropriate skills and experience permeated many of the decisions that were taken by the BIW engineers.There was a pressing interest in the reliability

and ease of maintenance of the technologies surveyed. In essence, the BIW engineers were anxious that the technological systems installed in the New West should be 'proven' ; that is, they should be of demonstrable reliability and efficiency in a mass-production situation. In the words of a senior BIW engineer ; "Whatever system we have has got to produce, be proven." (13)

Table Two serves to indicate the impact that such considerations had in the major area of 'body-framing' systems. It also provides a specific example of what Salerni calls the 'incorporation of social constraints' in the development of process technologies (14).

TABLE TWO

Socio-technical criteria and the 'body-framing' process

	ADVANTAGES	DISADVANTAGES
A.B.F.(I) :		Not proven in production, detailed examination revealed 'practical problems'. Little experience with robots in BL : one experimental robot at Cowley (15)
A.B.F.(II):		Technically feasible to employ one module for 6,500 per week. But two modules offered greater flexibility in case of major breakdown (16).
A.B.F.(III):	Most common A.B.F. method in use (Fiat, Volvo, Datsun and Citroen). It was noted that Fiat had similar labour problems to BL (17). "The latest Unimates can be considered reliable." (18)	
Gateline :	From 1969 preferred method within BL : in use at Longbridge and Cowley for four different models (Allegro, Maxi, Marina, Rover SDI).	
Eurobuck :		Had been employed at Speke no.2 plant. Associated with the low productivity problems of that plant.

c) Technical criteria

Within the design framework established by the above-mentioned social and economic parameters, the part played by purely technical considerations seems to have been comparatively small. By and large, the application of Technical criteria served as the final, detailed constraint on the choice of technologies. In the broadest sense, such criteria mediated between the means to means, rather than means to ends, relationships of the design process. They carried the greatest weight in defining the coordination and integration of the various sub-processes within the BIW plant, ensuring that they all conformed to a coherent technical format and were capable of operating interdependently. A typical example of their application to design comes in the decision on the method of production for the major Body-side sub-assembly. The eventual decision to opt for a mechanized multi-welder system - in preference to the manual alternative - was motivated not by economic considerations but by the technical need to ensure that Body-side supply to the 'body-framing' process achieved the necessary high levels of quality and continuity.

The implications of Technical criteria for the 'body-framing' process itself are detailed in Table Three.

TABLE THREE

Technical criteria and the 'body-framing' process

	ADVANTAGES	DISADVANTAGES
A.B.F.(I)	:High degree of flexibility : up to 11 derivatives.£700,000 incremental cost for new model (19).	Not available from suppliers.Robots not suited to body framing. (20)
A.B.F.(III)	:Re-spot welding the best application for robots, and the recommendation of Unimation.Eliminates tagging of body by complex multi-welder and butterfly gates format.No manual re-spot welding (21).	
Gateline	: Eliminates 'idle time' during 'indexing' (a feature of 'static' build).Faster cycle time and single material feed (22) system.£300,000 for model change.(23)	
Eurobuck	:	Not possible to perform all the framing welds automatically : a number of welds carried out between jigs.
Static	:	Idle time during indexing - while body transported from jig to jig.

Technological alternatives

During 1976 there was a period of about six months intensive evaluation as BL's BIW engineers applied the various criteria outlined above to the decision on a 'body-framing' process for the New West. Although initially both the Eurobuck system developed by Ford and the conventional Gateline method were in contention for this choice,it quickly became clear that some form of automated system - Auto Body Framing - was the only practical solution to the BIW engineers' problems.Further,as Tables One,Two and Three indicate, of the three A.B.F. systems available the option which we have termed A.B.F.(III) was preferred on a number of counts.

In order to convey something of the complex process of elimination by which A.B.F.(III) was finally chosen from the range of alternative methods,it is useful to compare its characteristics with those of its rivals.Firstly,the comparison between A.B.F.(III) and A.B.F.(II) serves to indicate the importance placed upon reliability and protection against machine breakdown.A.B.F.(II),being a single 'module' system,offered certain technical advantages - notably maximum economies of scale.However,the advantage of the two module A.B.F.(III) was that it provided much greater flexibility in case of breakdown ; should one module be put out of action,production could at least continue from the remaining module.(24)

The decision between A.B.F.(III) and A.B.F.(I) was if anything even more difficult.Because A.B.F.(I) involved the use of robots in the tack-welding area where the body sub-assemblies are 'framed',it offered the greatest possible degree of flexibility.Unlike the A.B.F.(III) which employed a multi-welder for tack-welding,A.B.F.(I) could quite easily be switched from production of one model to another at a fairly small incremental cost.Nor was the A.B.F.(I) option significantly more expensive in installation or operation costs (25).For all of these reasons,there was a strong argument for the more flexible system, and,in fact,it was the original preference of the BIW engineers (26).However,despite its technical advantages this option was eventually rejected in favour of A.B.F.(III).The considerations that lay behind this choice were essentially two-fold ; first,the A.B.F.(I) method carried the burden of novelty and a lack of proven reliability (27).Secondly,and more importantly however,there was the simple fact that within the terms of reference set for AD088 production there was no need for the flexibility and sophistication offered by A.B.F.(I).

Ultimately,for all the social and technical aspects of the design process,the choice of the A.B.F.(III) system for the New West demonstrates,even at this level, the importance of the assumptions and objectives built into BL's corporate policy.Although the A.B.F.(I) method

would have facilitated model changes,the role of the AD088 in Ryder's model strategy was such that no body-type changes were envisaged.The precedence given to A.B.F.(III) over A.B.F.(I) thus flowed directly from the strategic priority accorded to the AD088 as a ten plus years,no BIW derivatives,centre-piece of BL's model range.

In this perspective,the process of technological choice at Longbridge only serves as the empirical counterpoint to the theoretical conclusion presented earlier ; quite simply,that the large-scale introduction of new technologies is best viewed in terms of the 'strategic choice' exercised by management.As Woodward notes ; "In the long term,the technology of an organ-ization is for the most part a result of a series of managerial decisions to serve specific markets,to acquire or build plant,to accept certain types of raw materials,and to address the organization to certain production tasks."(28).Indeed,the increasingly competitive character of the motor-industry itself seems to lend an extra importance to this link between technology and management strategy.For example,in BL's 1982 Corporate Plan explicit acknowledgement is given to this factor ; "BL must be competitive in its adoption of appropriate technologies or fail...part of a BL-wide effort to develop the right choices and to coordinate plans so that effort is not wasted." (29)

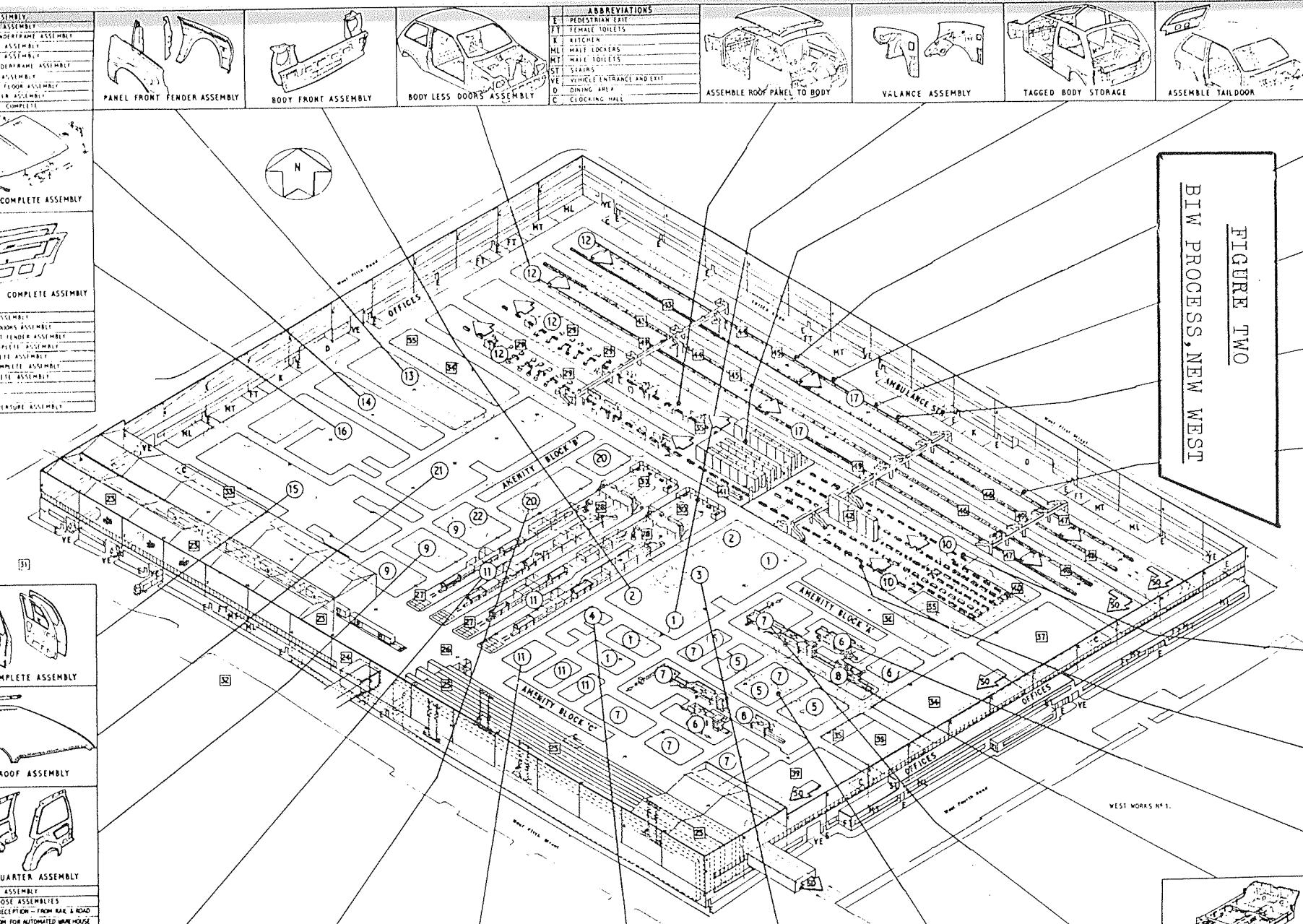
Technological Systems

As Figure Two illustrates, the many different choices, both major and minor, made by BL's BIW engineers were eventually all incorporated into the New West BIW plant itself : an integrated plant in which all of the many welding and assembly operations of BIW manufacture were to be performed. The flow of production was to be mainly sequential in character - from receipt of the body-panels and their storage in the Automated Panel Store, through the various sub-assembly areas and into the robotized A.B.F. lines, the car body-shells finally being completed on the long manual finishing lines by the addition of 'bolt-on' items (doors, tailgate, wings).

All of the specialized tasks were wrought into a continuous, unceasing flow by a whole range of information, control and materials handling systems. Thus, although the degree of mechanization varied from one sub-process to another (the body-framing lines automated, finishing lines manual), it would be a mistake to view the plant as simply a loose collection of heterogeneous operations (30). Indeed, throughout the plant the production process was tightly controlled by a large array of control and monitoring devices, with each specialized operation linked to the rest by a seven miles long overhead conveyor system. The conveyors took completed sub-assemblies from one part of the plant, and fed them directly into each major assembly area (the Kuka 'Underframe' process, Body-side

FIGURE TWO

BIW PROCESS, NEW WEST



1	VALANCE ASSEMBLY
2	BODY FRONT ASSEMBLY
3	FRONT END UNDERFRAME ASSEMBLY
4	DASH UPPER ASSEMBLY
5	DASH LOWER ASSEMBLY
6	REAR END UNDERFRAME ASSEMBLY
7	MAIN FLOOR ASSEMBLY
8	UNDERFRAME FLOOR ASSEMBLY
9	INNER QUARTER ASSEMBLY
10	UNDERFRAME COMPLETE

ABBREVIATIONS	
E	PEDESTRIAN EXIT
FT	FEMALE TOILETS
K	KITCHEN
ML	MALE LOCKERS
MT	MALE TOILETS
ST	STAIRS
VE	VEHICLE ENTRANCE AND EXIT
D	DINING AREA
C	CLOCKING HALL

11	BODY SIDE ASSEMBLY
12	BODY LESS DOORS ASSEMBLY
13	PANEL FRONT FENDER ASSEMBLY
14	BONNET COMPLETE ASSEMBLY
15	DOOR COMPLETE ASSEMBLY
16	TAILDOOR COMPLETE ASSEMBLY
17	BODY COMPLETE ASSEMBLY
18	
19	
20	TAILDOOR APERTURE ASSEMBLY

21	PANEL ROOF ASSEMBLY
22	SHIPPED LOOSE ASSEMBLIES
23	BODY PANEL RECEPTION – FROM RAIL & ROAD
24	CONTROL ROOM FOR AUTOMATED WARE HOUSE
25	AUTOMATED WAREHOUSE – PANEL STORAGE
26	BODY PANEL – DISPERSAL TO FACTORY ZONES
27	AUTOMATED PANEL TRANSFER SYSTEMS
28	ROBOT HANDLING – BODY SIDE ASSEMBLY
29	ROBOT WELDING – AUTO BODY FRAMING LINE
30	BODY SIDE ASSEMBLY – RECTIFICATION

31	COMPACTOR – CARDBOARD WASTE
32	BASIC SERVICES BUILDING
33	MAINTENANCE BASIC SERVICES
34	TOOL ROOM SERVICES
35	INSPECTION
36	UNDERFRAME RECTIFICATION
37	CENTRAL INSPECTION
38	STORES
39	F.D. OILING & DESPATCH
40	STORAGE AREA

41	RECTIFICATION TAGGED BODY
42	BODY TRANSFER FRAMES STORAGE TOWER
43	WELDING & BRAZING BOOTHS
44	DISCING & GRINDING BOOTHS
45	WINDSHIELD SETTING
46	HIGHLIGHT BOOTH
47	DISCING BOOTHS
48	VACCUM CLEAN BODY COMPLETE
49	PEDESTRIAN BRIDGE
50	O/H BODY CONVEYOR TO SOUTH WORKS

PANEL FRONT FENDER ASSEMBLY

BODY FRONT ASSEMBLY

BODY LESS DOORS ASSEMBLY

ASSEMBLE ROOF PANEL TO BODY

VALANCE ASSEMBLY

TAGGED BODY STORAGE

ASSEMBLE TAILDOOR

BONNET COMPLETE ASSEMBLY

TAILDOOR COMPLETE ASSEMBLY

DOOR COMPLETE ASSEMBLY

PANEL ROOF ASSEMBLY

INNER QUARTER ASSEMBLY

ASSEMBLE DOORS

ASSEMBLE FENDERS

ASSEMBLE BONNET

BODY COMPLETE ASSEMBLY

UNDERFRAME COMPLETE ASSEMBLY

TAGGED BODY ASSEMBLY

REAR END UNDERFRAME ASSEMBLY

NUMBERS IN CIRCLES THUS (6) INDICATE ASSEMBLY ZONES

UNDERFRAME FLOOR ASSEMBLY

BODY SIDE ASSEMBLY

TAILDOOR APERTURE ASSEMBLY

CANTRAIL & 'A' POST CLOSING ASSY. REINFORCEMENT 'A' POST LOWER ASSY.

DASH UPPER ASSEMBLY

FRONT END UNDERFRAME ASSEMBLY

DASH LOWER ASSEMBLY

MAIN FLOOR ASSEMBLY

REVISIONS

METRO BODY BUILD —— WEST WORKS Nº 2

PRODUCTION ENGINEERING BODY AND ASSEMBLY

AUSTIN MORRIS LONGBRIDGE OPERATIONS

FACTORY
BUILDING
BAYS
COLUMNS

LONGBRIDGE, BIRMINGHAM 31 (0121 475 2001)

DRAWING No
BY
PLANNED
BY
DATE
INV. No.

SCALE
SHEET OF
AO

assembly,Body-framing and so on).

At the very beginning of the production process, the Automated Panel Store (APS) serves as a useful example of the link between the orginal strategic decisions on the BIW plant and the subsequent design stage.The APS was required to cope with 16,000 pallets of panels from 35 different suppliers each week, transported via 105 lorries and up to 9 trains.In its four 450 feet long 'aisles' and 3,000 storage racks it needed to store up to one week's production of body panels - that is,7,800 'car sets'.Given its huge capacity and the speed at which it was required to supply the production areas (only one minute's notice), it followed fairly directly that the APS would be controlled by computers and not by men.As the original 'justification proposal' for the APS noted : "It has been established that no manually operated procedure would be capable of keeping each of the stack and retriever cranes continuously supplied with instructions to realise the required levels of operating.Therefore,full computer control of all warehouse functions is proposed." (31) A total of seven mini-computers were employed in the store to provide that control,with the aim (which even modern computer technology could barely fulfil (32)) of controlling the issue and receipt of panels,and securing the 'optimization' of inventory control.

Another feature of the APS which was typical of

the rest of the plant was a built-in concern for what can usefully be termed the 'technical integrity' of the system.In order to ensure production continuity, the APS was provided with four possible 'fall-back' positions which would preserve its integrity by allowing it to operate at some reduced level even in the event of major mechanical or computer breakdown.The stores management system was based on a 'duplexed' arrangement of two mini-computers ; one 'Master' to control the day-to-day operations of the APS,the other a 'Standby' to assume the controlling role within a space of just two minutes in the event of the former's breakdown.

This concern for 'technical integrity' was replicated throughout the plant.For example,there was extensive provision of 'buffer stocks' both within machine systems and along the conveyors themselves,all with the basic aim of protecting the production system for 1½-2 hours at least against the disruption caused by technical failures in one part of the BIW area. Further,in order to ensure the efficient operation and coordination of the various systems within the New West,there was an all-embracing network of control devices,comprising over 100 Programmable Logic Controllers and 21 mini-computers.All these electronic controls were serviced by special single co-axial cables capable of accepting up to half a million voice,video and data communications through an equal number of terminals.

Of just as much concern to management as production continuity was the question of product quality.The aim of achieving an unimpeachable degree of quality for the Metro (unlike some previous models from BL) led to the development and installation of a general hierarchy of quality controls in the New West.Firstly,the PLCs (Programmable Logic Controllers) and Compact Weld Controllers,which were attached to the multi-welders, monitored the quality of each weld performed on the body-shell.Secondly,a three-dimensional measuring machine was employed to carry out sample measurements on certain bodies twice each shift.By employing computer control,this machine was able to perform in just five hours a long inventory of measurements which to perform manually would have taken two or three days.Thirdly, inspection procedures at the end of the BIW process provided the New West's production manager with almost immediate 'feedback' on fault analysis trends and 'right first time' rates,via a computer terminal stationed in his office.

The overall degree of control and integration afforded by these information technologies is well conveyed by the following passage from 'Computing' magazine :

> "..a typical operation at the plant might look like this ; a Plessey light-pen picks up the bar-code on a particular car.If the car has a fault on it,then the pen runs over a special fault card under that car's

> file.This information then goes into the Ferranti communication system,may show on a screen for an inspector and go on to a mini (computer) to plan the procedure for correcting the fault. Another..mini-computer may then handle the communications back to the Redditch computer centre where the I.B.M. machines will look for trends and compile statistics." (33)

Technology and the work-force

In 1954 Caplow perceptively outlined the technological trends of modern industry in the following way ;

> "..modern organization is unmistakably bent towards the elimination of cooperation as a moral and emotional element in work so that cooperation as a technical coordination of resources may be enhanced.In the former case,cooperation is something which may be freely given or withheld ; in the latter it is an abstract quality of a productive system in which necessary functions are appropriately interlocked." (34)

The elimination of subjective cooperation in favour of objective coordination was an important feature of all the technological systems surveyed up to this point.The search for 'technical integrity' in the design of the plant,for example,clearly reflected certain assumptions about the role of labour,and the need to minimize the discretion and control exerted by labour.As Davis and Taylor note in another context ; "When assumptions are held that a system is composed of reliable technical elements and unreliable social elements,then in order to provide total system reliability,the technical design must call for...people as replaceable machine elements to

be regulated by the technical system or by a super-structure of technical control." (35).Indeed,excepting the labour-intensive finishing-lines of the New West, the part played by human labour in the BIW process was fully encompassed by and integrated within the technical framework established by the various machine and computer systems.In many areas labour was reduced to the level of an 'appendage' to the machine,either servicing it or loading parts into it.

The reduced technical status of the work-force did not mean,however,that the workers themselves were closely subjected to the pace and rhythm of the the machines that they served.With the specific objective of protecting the predictability and objectivity of their machine systems,the BIW engineers at Longbridge had sought quite deliberately to segregate men from machines in the BIW process.They achieved this mainly by the provision of 'buffer stores' within the machines which effectively separated the machine-loader from the operational cycle of the machine itself.Their motives in this respect were largely technical in character : the different characteristics of man-controlled operations (frequent,short duration 'interrupts') as against machine-controlled systems (infrequent but long duration 'interrupts') meant that to mix men and machines would produce an 'uncontrolled interaction' which was not acceptable in the high volume context of the New West. (36)

This is not to say,however,that BL's engineers did not perceive any non-technical benefits arising from the mechanization of production within the New West.They were quick to recognize,for instance,that the provision of 'buffer stores',by breaking up the usual work-groups and 'aggregates' of labour,might actually reduce the kinds of social constraint which normally hampered machine efficiency,A senior Industrial Engineering manager estimated that by fragmenting and isolating a group of 10 to 12 workers in this way,the use of 'buffer stores' could increase machine efficiency levels by around 12% (37) The same manager was also generally enthusiastic about the potential that technology held for overcoming uncooperative or resistant labour-forces ;

> "I would argue that traditionally labour relations have been predominantly controlled or motivated by group theory..technology breaks down those groups and isolates the workers...Technology can break down the skill barriers and turn the operators into automata - and this is not only the production operators,it can largely break down the skill barriers even in more traditionally skilled areas through diagnostic systems and so on." (38)

This acute perception of the control potential of technology is almost a précis of Braverman's analysis. Certainly,it serves to provide empirical support for comments made by Warner and Low some thirty years before : "Control problems are simplified on two counts : (1) machines are easier to control than human beings and (2) mechanization tends to disrupt the social solidarity of the workers...these factors tend to increase

the subordination of the individual worker to management." (39)

However,while the drive for technical control of the work-force was undoubtedly an element in the BIW design process,it would be easy to overestimate its overall significance.As our earlier survey of technological choice for the plant suggested,the overriding considerations in the design of the major machine systems seem to have been mainly strategic in character. In this perspective detailed questions of shop-floor control appear to be largely marginal annotations to the general thrust of the design process.Indeed,even at a detailed level it is the degree of mechanization in the New West and its inevitable corollaries of predictability and impersonality which seem to have the greatest impact on the social organization of the plant - rather than,say,the relatively trivial matter of 'buffer stores'.(40)

Technology and productivity

If labour's 'subordination within production' was an implicit rather than a salient factor in the technological design of the BIW process,its 'subordination to production' presented management with many more problems.Most of these problems devolved upon the industrial engineers at Longbridge insofar as they were given the task of ensuring that the new plant and

its work-force achieved the planned levels of productivity.Although the New West had been designed for certain high standards of productivity,the industrial engineers' task was something which technical factors alone could not achieve - namely,the task of translating the purely technical efficiencies of machine cycle times,conveyor speeds and so on,into qualitatively social standards of worker behaviour.

The initial steps in executing this task were taken at the same time as the technological framework of the New West was being defined.Beginning with only a sketchy outline of production volumes,process flow and method, the Industrial Engineering function developed the first crude parameters for manning levels in the new plant.By July 1976,Divisional Industrial Engineering had reached agreement with their Longbridge colleagues that the AD088 would have a work content of around 30 man-hours in Body and Assembly (41).As the technological detail was fleshed out over the succeeding period,the industrial engineers further refined their standards,such that by 1980 the work content of the BIW process had been reduced from 5.15 to 4.495 hours per car (the BIW output per week divided by weekly man-hours).This kind of cheeseparing of minutes and even seconds from work time was achieved by tortuous calculations based on 'synthetic' work standards.

However,while the industrial engineers' methods

were technical, their objectives and assumptions were clearly non-technical in nature. The major criterion employed in their calculations, for example, was what Davis, Canter and Hoffman call "the criterion of minimizing immediate cost of producing", for which "the usual indicator of achievement is minimum unit operation time" (42). And yet, insofar as the 'minimum' time for a job depended upon the human worker who performed it and what he or she would accept or could be made to accept, the central content of industrial engineering was in some sense political. As Baldamus rightly notes ; "The object of the rate-setting process is to discover the upper limit of tolerable effort, this is, the highest standard that can subsequently be maintained without restriction of output or strained industrial relations."(43)

Despite the technical pretensions of the 'industrial engineers', they were themselves acutely aware of the political implications of their actions. A senior industrial engineer admitted that as a general rule they sought to 'smooth' manning requirements within a section so as to avoid creating arguable issues with the shop steward. Moreover, even their access to the shop-floor for purposes of work measurement was a matter of negotiation - the maintenance trades, for instance, had always consistently rebuffed any attempts at work study (44).

Manning levels in the New West

The political salience of the industrial engineers' role was less apparent, however, in the development of work standards for the New West. As the new plant was in many respects a 'greenfield' site, the industrial engineers were able to relate their work standards and manning levels directly, if not objectively (45), to the technological framework of production. Thus the standards and efficiencies which are discussed below represent simply the design standards for the BIW process - that is, they were based on the levels of manning and output which the New West was designed to achieve. It follows that their application to production depended greatly on the extent to which management could secure or even advance them against the shop-floor controls of the trade unions. (This is discussed in more detail in the following chapter)

Having said that, however, it seems clear that the injection of over £200 million of capital investment into the Longbridge site could hardly fail to bring some considerable increase in productivity. The transformation produced by the investment was most noticeable in the BIW area : there was a tremendous contrast between the BIW production lines for the Mini which were primitive and obsolete even by the standards of the late 1950's, and the highly automated and ultra-modern lines and systems of the New West. The new plant

had benefitted from an investment of over £25 million in process technology alone - the major Kuka Underframe machines costing around £10 million,and the Sciaky A.B.F. system around £8½ million.While only 10% of the Mini's BIW spot-welding was mechanized, the comparable figure for the Metro was 80%,making the New West one of the most automated plants in the European motor-industry (46).

It is difficult to provide any precise definition of the impact that this investment had on the levels of productivity at the plant - the effects of changes in technology are almost impossible to isolate from the general social and organizational changes associated with the introduction of a new model.A useful if approximate indication can be gleaned,however, from the comparison of manning levels in particular areas of new and old facilities respectively.For example,the effects of computerization in the APS are indisputably clear in the comparison with the stores function in the Old West (the BIW area for the Mini and Allegro);in the new plant the stores were managed by a total of seven people over two shifts, while in the Old West 54 storekeepers were employed in manual stores control.

The mechanization of production brought productivity gains of a similar order,as the example of the Kuka Underframe machine detailed in Table

Four cogently illustrates.

TABLE FOUR

	Kuka U/frame	Allegro U/frame
Direct labour :	8	20
Indirect labour :	5	7
Staff :	1	2
	14	29
Production	72/hr.	29/hr.

Comparison of Metro v.Allegro Underframe : production and manning levels

Source : BL internal documents

These figures suggest that,when operating at full capacity,the Kuka Underframe machine in the New West offered an increase in labour productivity of the order of 500% compared to the manual Underframe methods for the Allegro.This is not to say,however, that all the increase can be attributed to technological change.In fact,in this particular instance a direct comparison between mechanized and manual production of the Metro's Underframe (possible because of the very limited use that was made of a separate manual facility for producing KD sets) suggests that the

technological component of the increase was only of the order of 300% (47). It further leads to the admittedly tentative conclusion that around 200% of the difference in efficiency between Metro and Allegro production can be attributed to a combination of a simpler product design and improved working conditions.

Even so, there is no doubt that the installation of automated technologies did have a significant impact upon manning levels in the new plant. Their effect is exemplified by the case of the A.B.F. system, which with its two lines of 14 robots represented the acme of technological sophistication in the New West. Table Five illustrates the massive increase in productivity which the new technology brought.

TABLE FIVE

	Manning levels (one shift)		
Process	Mini	Allegro	Metro
Jig-build	36	31	1
Final Weld	27	36	0
Tradesmen	9	16	15
	72	77	16

Body-framing process, manning levels

Source : BL internal documents. (48)

Although examples such as the A.B.F. and the Kuka Underframe machine are in some ways unrepresentative of the BIW process as a whole - insofar as they were the most automated processes within the plant - the overall effect of both the capital intensity and integration of production within the New West was clearly reflected in both the size and composition of the labour-force. Table Six presents the manning figures for the plant as a whole.

TABLE SIX

Production labour		Indirect labour		Misc. labour	
Directs	: 674	Maintenance	: 193	Fork-lift drivers	: 20
Labourers	: 18	Inspection	: 122	Cleaners	: 9
Semi-directs	: 36	Production + Material Control	: 22		
Tip-dressers	: 28				
	756		337		29

Total manning (two shifts) : 1122

Manning levels, New West (two shifts)

Source : BL internal documents

When these figures are compared with the manning levels of, for example, the Allegro, the overall productivity advantage of the New West is inarguable. For the Allegro BIW process, 369 manual workers were employed

to produce 900 bodies per week, but in the New West the 1122 manual workers were capable of producing 6500 bodies per week - a productivity increase of 137%. It is worth noting, however, the considerable margin of advantage gained by the New West's facilities was dependent on the plant working at its full capacity of 6500 BU bodies per week. This is an important point to note, for just as there was no guarantee that the industrial engineers would be able to secure the design work standards for the plant, equally there was no guarantee that market demand for the Metro would be sufficient to allow the New West to operate at full capacity.

As was discussed earlier the major objective of installing the new technologies at Longbridge was to raise the plant's productive efficiency to a level comparable with BL's major competitors. The BIW process was the area which gained the most from modernization, and consequently it is not surprising to note from Table Seven that planned productivity levels here were on a par with and in fact higher than comparable figures from Ford. Table Seven also shows that the BIW process for the Metro was a great improvement in terms of efficiency upon the existing Allegro lines in the Old West. The Table itself is based upon the industrial engineers' measures of productivity which are expressed as 'Budget Work Standard' man-hours per car - that is the basic measure used to determine manning levels.

TABLE SEVEN

Metro	Allegro	Ford Fiesta (Britain)	Fiesta (Germany)
4.118 hrs.	9.658	5.951	5.844

Budget Work Standard, BIW process : BL and Ford

Source : BL internal documents

To place these figures in context, it is worth noting the total hours per car figure for the Metro (from Pressings to Final Assembly) against comparable models from both BL and Ford.

TABLE EIGHT

Metro	Allegro (1300)	Mini (1000)	Fiesta (Britain)	Fiesta (Germany)
51.068	88.662	76.892	55.168	31.091

Budget Work Standard, total hours/car : BL and Ford

Source : BL internal documents

In essence, these figures suggest that while the BIW investment at Longbridge had brought BL up to the kind of productive efficiency achieved by the major

European producers for that particular area, the overall picture was less favourable. Even though major gains had been made over the productivity records of the Allegro and the Mini, the total hours per car figure suggests that BL still had some way to go in matching the levels of productivity achieved by Ford of Germany.

Conclusion

Although this chapter has focussed specifically upon the new technologies in the BIW process at Longbridge, in many ways it has actually served to underline the overriding influence of non-technical factors on both the design and operation of these technologies. It was noted, for example, that BL's market strategy for the AD088/Metro played an important part in determining the technological decisions on the BIW plant. Moreover, despite the technical sophistication of the plant, its operational efficiency was seen to depend in large part upon the marketing success of the Metro - should the Metro make a poor impression in the market-place, the BIW plant would operate at under-capacity levels, thereby jeopardizing its design efficiencies.

But while the market strategy of the firm was an overarching influence upon the BIW technologies at Longbridge, at a more detailed level their operation was seen to be closely intertwined with various social factors. Not only did the social structure of Longbridge itself act as a constraint upon the design process, but,

in terms of production efficiency, management's ability to install and secure the projected productivity standards was closely linked to the prevailing state and climate of industrial relations. In fact, the role of organized labour can best be described as an ever-present if shadowy figure in the background throughout the chapter. The next chapter, however, will place labour in the foreground of our view by examining the part played by the unions in influencing the processes of technological change at Longbridge.

TABLE NINE

BODY CONSTRUCTION METHODS

Auto Body Framing (III) : Pre-assembled body-shells, located by 'toy tags',are fed into an indexed shuttle line through a two stage multi-welding system which locates the panels by a press and weld operation.The multi-welders weld the body into a complete,rigid form ready for later re-spot welding by 14 robots on each line.Production is from two parallel lines.

A.B.F. (II) : As A.B.F.(III),except that production is from one module only.

A.B.F. (I) : As A.B.F. (III),except that the multi-welders are replaced by robot welding stations. Production is from two modules.

Eurobuck : Body panels located by static gates.The automatic clamping system incorporates automatic welding heads,and while the components are held together these heads perform a partial welding operation on the body (similar to multi-welders).Between the two framing gates a number of manual spot-welds are performed.Then after framing the finish welding is performed conventionally.

This method was the preferred choice of Ford - it was installed at Halewood in 1980 for production of the new Escort.

Gateline : The build jig containing the body-shell assemblies moves along a continuously moving line until a firm structure has been spot-welded together. The body then remains on the conveyor for spot and fusion welding.This method eliminates the man-handling of components to the line which is a feature of 'Static' methods.Employed for the Allegro at Longbridge.

Static : Bodies are progressed through two or three stationary box jigs,and manually spot-welded until the body is a sufficiently firm structure to remain intact for later build operations.The most primitive of all the methods surveyed.Employed for the Mini at Longbridge.

CHAPTER SEVEN

WORKER PARTICIPATION IN TECHNOLOGICAL CHANGE

Introduction

During the period of gestation for the Metro model - roughly the five years between the Ryder Report in 1975 and the car's launch in October 1980 - the trade unions at Longbridge were provided with an almost unequalled opportunity to exercise some influence over the processes of technological change.Quite apart from the leverage that they were able to exert through the traditional forms of collective bargaining,the mechanisms of worker participation established by Ryder offered the trade unionists at the plant a unique degree of access to the planning and design of changes in production technology.Their influence on these normally exclusively managerial processes not only has important repercussions on the examination and analysis of events within Longbridge,but also raises more general questions about the possibilities of any kind of trade union control of technological change (1).

Before investigating the details of the Longbridge case itself,however,it is perhaps worthwhile to briefly

note some of the history and character of worker participation in general.For although the participation arrangements established under Ryder were both wider in scope and more grandiose in scale than anything previously devised,the history of British industry reveals a number of like-minded if less grandiose schemes for consultation or participation.As far back as 1941,for example,a joint 'Management Advisory Committee' was set up at Vauxhall Motors,and by the early 1960's the Longbridge plant itself was operating a 'Joint Production Committee' of management and shop stewards.More recently,in the U.S.A. a trade union official has been offered a seat on the board of the troubled Chrysler Corporation (2).

However,while there is clearly no shortage of schemes in which workers are consulted by management or even involved in managerial decision-making,the character of such schemes and of worker participation in general is open to a wide range of possible interpretations.It could be argued,for instance,that participation or industrial democracy represents a more extreme form of the kind of 'penetration of management' described by Flanders - that is,the trade unions undermining more and more of the managerial prerogative and establishing in its place a system of joint regulation (3).It seems debatable,however,whether systems of participation or consultation which are often freely proffered - rather than reluctantly given up - can be

usefully treated as equivalent to the concessions secured by collective bargaining power.

On the other hand,where a participation scheme is not the product of substained trade union pressure,it seems unlikely to be simply an expression of managerial benevolence or philanthropy.Rather,it seems far more likely to be an attempt to use the form of a participation scheme as a device for exerting some degree of control over the work-force.Since trade unions themselves tend to act as what Herding calls "tools of capitalist integation to channel and administrate labor protest" (4),the possibility of the formal arrangements of particpation being exploited in this way does not seem implausible.Indeed,insofar as the timing and structure of such schemes are determined by management,the likelihood of their serving managerial interests seems very great.Certainly,in his survey of a number of projects of 'industrial democracy' Bolweg found this to be very much the case.He concluded that "the local employer is very pragmatic in his reasoning whether or not to start a change programme (of participation) at shop floor level. In most cases he will initiate a project as a response to a specific managerial problem" (5).

The purposes which participation can serve for management are many and varied,depending chiefly it seems on the 'specific managerial problem' at hand.However,by and large,the benefits which management seek from

such arrangements seem to fall into two major categories ; control and efficiency.With regard to the former aspect,both Friedman and Smith talk of various forms of participation as 'strategies' for increasing management's control of the labour-force (6). More generally,Ramsay,in his survey of participation programmes in British industry throughout the twentieth century,speaks of them in terms of 'cycles of control',as successive waves of labour unrest throw up different kinds of institutional methods of control and suppression.He notes of such programmes that they "seem on each occasion to have arisen out of a managerial response to threats to management authority ...thus the initiative is management's and the consequence is,if significant at all,to nullify pressures to change the status quo,not..to stimulate reform" (7).

Apart from their ability to placate and eventually suppress labour resistance,participation schemes have also been employed as a means for increasing the productive efficiency of particular firms.This is especially so in situations where a downturn in market conditions or some other exogenous factor has put the organization's profitability under threat.The events at Chrysler U.S.A. in 1980 - with moves towards participation directly prompted by the firm's massive losses - seem to be an especially notable example of this aspect of participation.Moreover,the potential

ability of this form of management-worker relations to deliver tangible gains in terms of greater output or efficiency seems to be entirely in accord with managerial concerns.For example,in a survey of British managers,Guest and Fatchett note that ;

> "..the data on management attitudes indicate that managers continue to place a particularly high value on profit and efficiency and use these among their main criteria of success.If so,it follows that participation will be considered in instrumental terms - that is,by measuring the contribution that participation can make towards managerial objectives." (8)

To a large extent the suspicion that participation tends to serve management's objectives rather than the workers' own interests finds confirmation in a study carried out by Brannen,Batstone,Fatchett and White during the 1970's.(9).In this study,which examined the introduction of 'worker directors' at the British Steel Corporation,Brannen and his colleagues found that the search for efficiency played a pivotal role in the operation of the participation scheme.However, while it was hardly surprising to find that the majority of management involved in the scheme were "concerned with the relationship between efficiency and participation" (10),the most significant aspect of the study was the light that it cast on the approach taken by the workers themselves.According to the study,those members of British Steel's work-force who were involved in the scheme,far from rebutting managerial values, readily assimilated them as an intrinsic part of their

role in participation.As Brannen and his colleagues noted ; "For all worker directors,profit assumed the function of the main criterion of success,and with this went a willingness to argue within the economic categories determined by profit." (11)

The importance of the Brannen study thus lies not simply in its confirmation of the instrumental value which management find in participation,but also,and in some ways more importantly,for the light that it sheds on the effect of such schemes upon the workers involved. If,as we argued earlier,labour's 'subordination to production' is just as significant as its technical subordination,then management's ideological efforts to secure the workers adherence to values of efficiency and profitability take on a critical importance.Even if participation only succeeds in persuading the worker representatives to take an 'objective' view,it at least helps to achieve some degree of 'legitimacy' (12) for management's actions.To cite one example,a shop steward on the 'Management Advisory Council' at Vauxhall described his experience in the following way : "After a time on the MAC you do tend to alter.As a shop steward you took the attitude that the men were always right,and what came from the bosses always wrong.Now I take a more impartial view,and if you think what the bosses want is right then you support it." (13)

Participation at Longbridge

In proposing the creation of a system of worker participation within BL, the Ryder Report was clearly cognizant of the above-mentioned advantages of both control and efficiency. Citing industrial relations as a major problem area within the firm, Ryder's proposals defined participation in almost purely instrumental terms, seeing it as the means by which the frequency of disputes could be reduced and labour productivity increased. As the Report explained ; "The most crucial factor in improving Industrial Relations at British Leyland and in creating the conditions in which productivity can be increased is, however, that there should be some significant progress towards industrial democracy." (14)

In pursuance of the Ryder Plan, during 1976 BL management developed a comprehensive framework of management-union committees which were to operate at both plant and divisional level and were to be coordinated by the Board level 'Cars Council'. Although several plants - notably Jaguar at Coventry - opted out of the participation machinery, these arrangements were accepted by mass meetings of the work-force at a majority of BL's plants.

Our concern here, however, is not with the apparatus of participation in its entirety but with in some ways a relatively minor part of the whole scheme. This is,

the AD088 (later LC8) Sub-Committee which was established in November 1976 as a joint management-union committee at the Longbridge plant,and a part of the overall framework of practicipation.The committee's brief was concise and specific - to oversee the AD088/Metro project as it affected Longbridge,and deal with those elements of the change which could usefully be discussed outside the machinery of collective bargaining.Although a fairly small part of the whole scheme,the committee's membership was relatively high-powered : of the 11 shop stewards attending the initial meetings,most if not all were senior stewards within the plant,with the chairman of the Joint Shop Stewards' Committee - Jack Adams - being in regular attendance at the fortnightly meetings until the beginning of 1978.Equally,all of the eight managers on the committee either had some specific involvement in the Metro project itself,or were senior members of plant management (15).

From its inception,the committee adopted a business-like approach to the practicalities of surveying and controlling the changes in facilities resulting from the new model.The terms of reference established by management gave the committee a straightforward and concrete sense of its function which seems to have been lacking from most of the other organs of participation. Under these terms,the committee was,

"1) To ensure that all proposals concerning the AD088 project...are given proper consideration and sign-off.
2) To ensure that any queries relating to the AD088 project...are answered.
3) To ensure that items of a plant responsibility are planned and communicated properly,and are completed on time." (16)

Although management retained the executive responsibility for the AD088 project itself,the unions were able to ensure that the sub-committee would have a wide-ranging scope in monitoring managerial activities.It thus provided the unions with a great deal of information on the changes in technology proposed by management,plus the ability to cross-question members of the project team of management about their plans and designs many months before implementation.

Trade union involvement in the AD088 committee

Perhaps more than any other group of trade unionists in Britain,the shop stewards at Longbridge were thus provided,by way of the committee,with a notable opportunity to exert some influence over the design and development of technology.Proposals for new facilities were scrutinized even at the earliest stages of the design process.To cite one example of this,when the committee came to a discussion of job design,the following broad alternatives were presented by management.

Alternative A - conventional job design

Alternative B - improved conventional job design

Alternative C - semi-autonomous production groups

Alternative D - fully autonomous production groups (17)

However,the unions' ability to discuss and examine such proposals at an almost embryonic stage should not be taken as implying that they were called on to play a significant or creative role in the design process itself.In fact,as an earlier discussion indicated,they exerted comparatively little influence upon the choice of the major BIW technologies for the New West.It seems that as a general rule options and possibilities would be presented to the committee for joint discussion,but that the trade unionists played a mainly passive role with regard to the technical aspects,simply noting or commenting on the information put to them.(18).

In part the passivity of the trade unions in this area can be attributed to the simple fact that shop stewards on the committee lacked the necessary expertise to make a serious contribution.Indeed,their lack of technical involvement meant that they were effectively excluded from the earliest,and in many ways the most crucial stages of the design process.Even Derek Robinson, the plant convenor at the time (subsequently replaced by Jack Adams),accepted that "it was not possible for trade union members to be sitting on planning committees for long periods while the pre-planning stages were gone through" (19).As he commented at the time ; "We've got no research facilities,despite the wealth and research departments unions have got.We are not able to utilize them.We react to company proposals."(20)

In the face of the massive programme of technological change planned by management,it seems that the trade unions' influence was marginal at best.Without any technical frame of reference in which to locate the proposed changes,their concerns over the new technology seem to have been largely confined to those,in some senses,peripheral aspects of which they had direct working experience (21).In the New West,for example,although Derek Robinson talked of "building in a measure of control by the workman over his environment" (22) the stewards' contribution to the design process was largely,if not wholly,confined to the area of working conditions.Ironically,the one major element of the BIW technology to which the trade unionists pointed as their particular contribution was the use and provision of 'buffer stores' within the BIW process.Jack Adams claimed that this design feature embodied the unions' aim that "the individual should not be abused by the technology" (23).With around half-an-hour 'buffer' for each sub-process,he explained, "the bloke has half-an-hour's control over the machinery, and in fact he is controlling the process rather than the process controlling him" (24).What is ironic about these comments is that,as we described earlier,the provision of 'buffer stores' was quite consciously developed by management as a way of securing greater managerial control of production.

Overall then,it seems that while the trade unions

undoubtedly played an active part in the participation machinery as a whole, their contribution in the area of technological design was extremely limited. Even their major aim of improving and enriching jobs on the new production lines was relegated to a marginal position within the broad technological framework of production. As Bob Hitchon, one of the AD088 committee stewards, explained ; "We thought that there should be as much opportunity as possible for operator initiative in the production process, and this would have to fit in with the choice of technology." (my emphasis) (25)

Constraints upon participation

Despite these clear indications of the limited role played by the shop stewards on the AD088 sub-committee, to simply attribute their marginality to a lack of the relevant expertise would be spurious. Although in some ways expertise clearly was an obstacle to union involvement, a far more important constraint was that the trade unions actually accepted this limited role, and, indeed, found it satisfactory. Jack Adams, for instance, felt that it was "the most effective participation exercise that we took part in...less abstract than other exercises" (26)

In essence, the unionists' satisfaction with the AD088 committee seems to have reflected a fundamental component of their involvement in participation as a whole - namely the acceptance of the broad economic goals established by management. In the case of the AD088

committee itself,this seems to have involved a basic acquiescence in the economic objectives of the AD088 project.When the AD088 committee discussed the various technical options for the Longbridge plant,at no time were the economic goals of the new facilities seriously challenged.One result of this implicit acceptance of the managerial rationale for technological change was that the trade unions' involvement was commensurately narrowed in scope.As Bob Hitchon notes,the shop stewards on the AD088 committee "were constrained by economic factors to have a figure for so many 'man-hours per car' in the building programme so that the new model would yield the necessary returns on investment" (27).The importance of this acquiescence in the priority of economic factors was that it entailed an acceptance of the whole managerial justification for changes in technology - and hence of the particular projects for automation and mechanization discussed by the committee (28).Clearly,this left comparatively little margin for a more critical influence upon the design and development of new facilities.

Whatever the constraints on their role in the AD088 committee however,the unions seem to have had a fairly clear-sighted view of just what kind of contribution they wished to make.As the minutes of an early committee meeting note ; "The Trade Union representatives indicated that it was a management function to present proposals which they would willingly discuss."(29)

Nor was the trade union acceptance of the ADO88's economic objectives an unconscious or unthinking one.. Rather, the Longbridge stewards - under the leadership of Derek Robinson - had actively embraced the Ryder proposals for BL, including Ryder's definition of participation as "a forum in which representatives of British Leyland's workers can contribute effectively to improving British Leyland's efficiency" (30). Their precise reasons for welcoming participation were somewhat different in character, however, from the intentions of its managerial architects. Derek Robinson in particular, being a member of the Communist Party, had a well-defined theoretical view of participation, seeing it as especially appropriate to the existing stage of capitalist development. One result of this view was that he perceived a direct political motive for the unions' involvement ; "if we make Leyland successful it will be a political victory. It will prove that ordinary working people have got the intelligence and determination to run industry." (31)

Management's involvement in participation

If anything, the shop stewards at Longbridge seem to have had a more profound commitment to participation than management themselves. Although the Ryder Report had stressed participation's role in developing "an atmosphere of joint problem-solving" (32), and an

internal management report had stressed the need for some 'give and take' on the part of management (33), even so many managers at Longbridge showed little if any principled commitment to the participation scheme. With regard to the AD088 committee in particular, the retrospective comments of some of the managers involved suggest that it was viewed in almost purely instrumental terms. For example, according to one of the senior managers on the AD088/Metro project team ; "Participation was a good P.R. (public relations) exercise." (34)

Far from seeing participation as an interactive exercise with the trade unions, management seem to have concentrated purely upon the contribution that it could make to solving managerial problems. In many ways this was hardly surprising since participation at the broadest level had been defined in terms of managerial goals such as efficiency. It followed that particular components of participation were justified in terms of their contribution to these goals. An official rationale for the AD088 committee itself ran to the effect that "employees are more likely to be committed to a new body build method if they have been involved in deciding that a change is desirable, what that change shall be and finally in its implementation" (35). Given this instrumental focus, it seems that the Longbridge managers were only conforming to the essential rationale

of participation in defining it as a form of persuasion or salesmanship.As one of the AD088 committee managers explained ; "Participation was a success.It helped us in selling the changes we wanted." (36)

One aspect of this approach to participation was that management emphasized its role as a device for communicating with the work-force - one manager even accused the trade unionists on the AD088 committee of 'slanting' communications with the workers,as if their task was simply to present the management view to their members (37).But it was not only in the area of 'communications' that management found participation beneficial.Especially in the crucial area of work practices,the AD088 committee seems to have served an important function in permitting and legitimating the 'objective' discussion of the kinds of radical changes in work practice sought by management.

One example of this aspect of participation is the joint management-union visit to Fiat's Mirafiori plant near Turin in September 1977.The AD0 88 committee (38) on this occasion was made up of ten trade unionists and five managers,and,although prevented from making contact with the Italian trade unions,the team did identify several aspects of Fiat's work practices as worthy of consideration.In particular,it recommended 'two trade maintenance' and other similar practices as important contributions to the improvement of Longbridge's productivity

record and its adaptation to new,automated technology. In this way,management's work practice proposals for the plant were rendered that much more palatable in the context of collective bargaining,even though they involved the elimination of much of the existing custom and practice at the plant (these proposals are discussed in the following chapter).

The overall impact of participation at Longbridge thus seems to have been especially beneficial to management.Not only did it facilitate the implementation of management's planned changes in production facilities,but it also gave an added force and 'legitimacy' to the proposals for major changes in the industrial relations system of the plant.Once such changes had been identified as 'rational and useful' (39), they could more easily be manoeuvred through the intricate web of collective bargaining (40).

Participation and Collective Bargaining

Although management at Longbridge found the system of participation - and the ADO88 committee in particular - to be useful elements in their 'management of change',by the end of 1977 events at company level were beginning to militate against the scheme.The installation of Sir Michael Edwardes as the chief executive of BL in November 1977 represented a definitive break with what had previously been the favourable

attitude of senior management.Unlike his predecessor Derek Whittaker,Edwardes did not take up a seat on the Cars Council on his appointment,and his general stance towards the participation machinery was quickly shown to be hostile.Indeed he later defined his own 'style of management' in the following very revealing way ; it certainly was not 'autocratic' he said "because we make no major decisions in BL without the full involvement of the board.And well before the board is involved,we involve anything up to some hundreds of managers in advance" (41) This kind of approach to industrial democracy was clearly incompatible with the arrangements devised by Ryder,no matter how much they served managerial purposes.

It would be a mistake,however,to attribute the demise of participation and with it the AD088 committee to the Edwardes 'style of management'.The fundamental problems for participation at Longbridge lay rather in its basic dissonance with a profound company-wide shift in the climate and structure of industrial relations.Although participation in the AD088 comittee had been established as quite a separate entity from collective bargaining - so that,as Derek Robinson explained,the unions would be able to "look objectively at some of the changes that were required outside of being in a bargaining position" (42) - yet,given its essentially political role for both management and unions, it could hardly fail to be affected by changes in the

balance of power within BL as a whole (43).

From the very beginning of Edwardes' programmes of rationalization,it was clear that participation within BL was no longer adjudged as of any practical value by senior management.The Cars Council was not even consulted about the closure of Speke No.2 plant, and subsequently the trade unions withdrew from the participation machinery at national level in protest at the lack of management cooperation.The AD088 committee,although still functioning at Longbridge, was badly affected by this major shift in management-union relations.The rationalization of BL in the Edwardes Plan in late 1979 carried the alienation of the trade unions a stage further,as management began to adopt an openly autocratic approach.At this time Derek Robinson began to see events as being shaped by "those from the employers' side who would like to return to the old days and reinstate management's holy right to manage" (44).Indeed so great was the shift in management's stance that Pat Lowry,one of the chief architects of participation,spoke of "the need for a far more active and aggressive management style..the need to influence and change workers' attitudes directly" (45).

As the climate of collective bargaining grew increasingly hostile and bitter,the meetings of the AD088 committee itself began to reflect the new mood

within the firm,gradually degenerating in terms of constructive or useful discussion.By the time that the trade unions at the plant finally withdrew from the committee in September 1979 it had become little more than a device for transmitting information.

Ultimately then,the reasons for the AD088 committee's eventual demise had little to do with the intrinsic problems of participation itself - in fact both managment and unions were favourable towards it - but rather more to do with a shift in the political balance at company level.By threatening,and indeed eventually succeeding,in undermining the fabric of collective bargaining within BL,this shift in power relations effectively destroyed the platform and the balance of power upon which participation had been erected.It appears that,within the context set by management's strategic response to economic decline and its associated attack on trade union power,the methods and the objectives of participation became basically untenable.To a degree this reinforces Storey's point that "there are finite limits to the extent to which managerial prerogatives can be abrogated.Participation or industrial democracy can only be incorporated in so far as the underlying rationale,as dictated by..(the)..structural 'facts of life' in a market economy is not seriously weakened," (46).

Conclusion

From the purely technical standpoint, the impact of the AD088 committee and its union representation on the technological changes at Longbridge was fairly minor. The head of the AD088/Metro project team chose to describe the trade unions' contribution to design mainly in terms of the choice of lighting facilities for the New West (47). Their limited role was not, however, simply the result of overriding technical considerations. To a large extent the limits on their contribution were self-imposed, reflecting their implicit acceptance of both managerial objectives and managerial initiative in design. It follows from this that any problems of expertise were less of an obstacle to the work-force's involvement in the technological change than the political and economic environment in which that change took place. Not only did that environment establish the overarching distribution of power and authority which rendered the unions so marginal to the process of change, but it was a shift in the economic environment of BL which eventually proved fatal to the participation scheme itself. All of which serves to underline the general point made by Brannen, Batstone and Fatchett :

> "There is no a priori reason why technical coordination should not take place through a more participative and less hierarchical system... the basic problems posed for participatory systems are not specifically related to technical coordination and authority, but rather the relationship of these to the wider social context of the market system." (48)

Apart from the light that it throws on participation in general, the example of the AD088 committee also seems to reflect certain of the critical changes that were taking place within BL at this time. It usefully highlights the implications of the new managerial approach for the introduction of new technology at Longbridge. In particular, it seems that although participation at the plant managed to secure what has been termed labour's 'subordination to production' - with stewards on the AD088 committee accepting the managerial goals underlying the project - by the end of the 1970's the whole scheme had become inadequate to management's purposes. Over the longer term participation was overtaken by a new managerial strategy in which the work-force's subordination was to be secured not by persuasion or cooptation but by a direct attack on trade union power. In the chapter that follows the ramifications of this attack, and the attendant political problems of technological change will be examined in some detail.

CHAPTER EIGHT

INDUSTRIAL RELATIONS AND THE METRO PROJECT

Introduction

"The success of the Metro project relates to a revolution in attitudes.There's an all-round commitment by shop-floor and management alike,and this is unprecedented in this company and probably British industry."

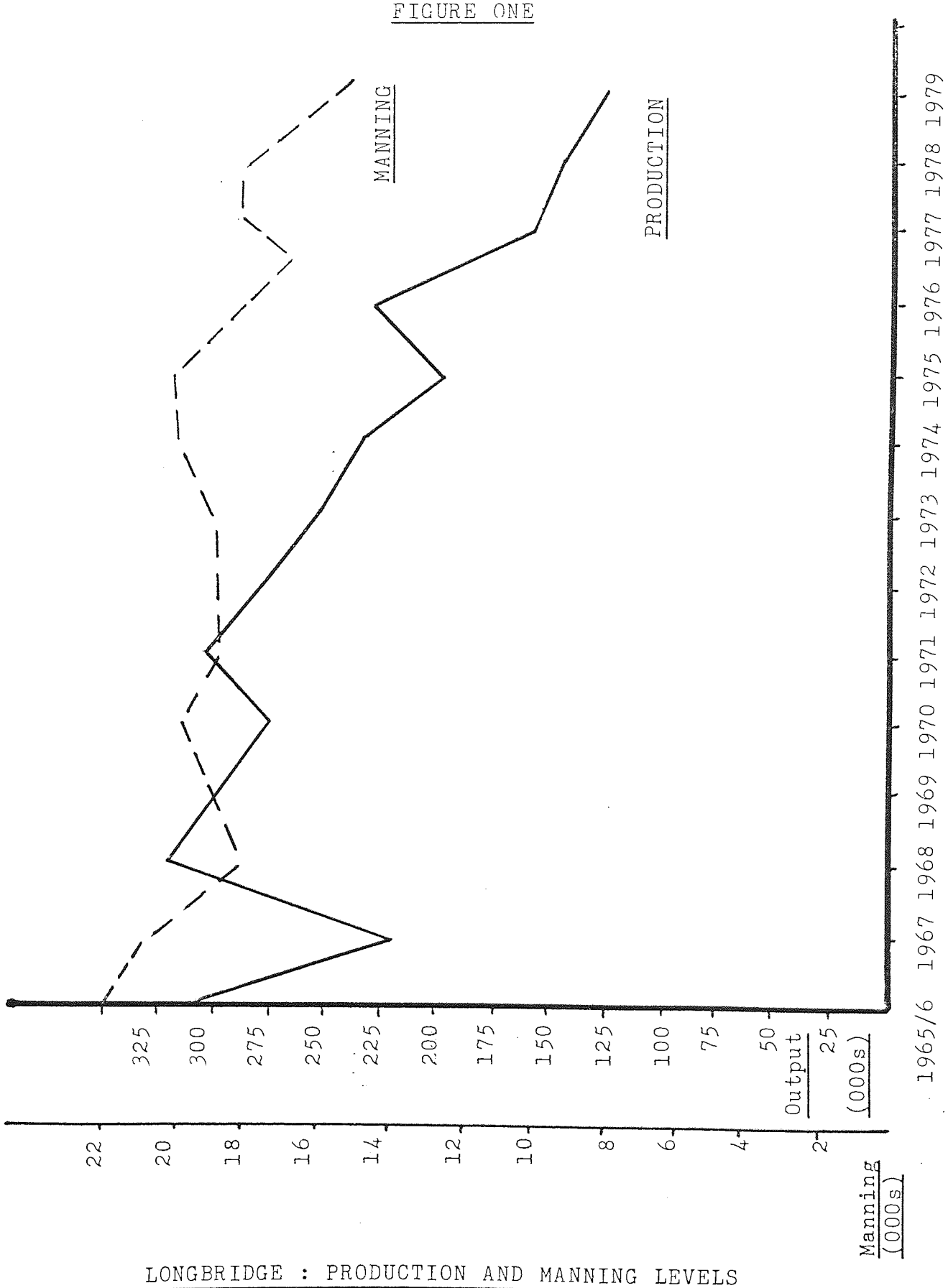
- Sir Michael Edwardes (1)

In the period after the launch of the Metro in October 1980,a number of more or less grandiose claims were made by both BL management and the Press (2) as to the transformation which had supposedly taken place at the Longbridge plant.To judge from these comments - typified by the above statement from Sir Michael Edwardes - management at the plant had finally succeeded in securing the long hoped for 'change in attitudes' on the part of the work-force.Whether this was in fact the case is something which the greater part of this chapter will seek to explore.In particular,the focus will be upon management's attempts to bring about those radical changes in work practice which were first mooted in the context of participation and the AD088 committee,

As we noted earlier, in the period after Ryder both management and unions at Longbridge began to take stock of BL's rapidly worsening situation. At that time some kind of consensus was developing within the firm, nourished by the openness of participation, which defined the question of labour productivity as a critical factor in BL's prospects of survival. There was a growing conviction on the part of the unions that important changes in custom and practice were inevitable if BL was to become competitive. At Longbridge in particular, this conviction was strengthened by, on the one hand, a dangerous trend of declining productivity (illustrated in Figure One), and on the other the increasingly material presence of the new technologies.

With production falling at an even faster rate than manning, the unions were receptive to a number of joint management-union exercises (including the visit to Mirafiori noted earlier) which produced an outline of the kind of work practices employed in the factories of BL's European rivals. Although the plans for the new facilities were still at a formative stage when these exercises were conducted in 1976 and 1977, nevertheless they had little difficulty in identifying a number of the important changes in work practice that would be 'necessary' for the operation of the new technologies. For example, the AD088 committee's report on its visit to Fiat put forward a number of radical changes in custom and practice. These included 'two trade maintenance, the elimination of many demarcations, and a greater level of

FIGURE ONE



LONGBRIDGE : PRODUCTION AND MANNING LEVELS

1965-1979

Source : BL internal documents

labour mobility.Indeed,so amenable were the trade unions to major changes in custom and practice at this time,it might reasonably be concluded that any 'revolution in attitudes' at the Longbridge plant occurred long before Sir Michael Edwardes was installed as head of BL.

As early as 1977 the Works Committee at Longbridge began to make representations to management with the aim of beginning negotiations on the changes in work rules and practices.They offered,in effect,to accept major changes in custom and practice in return for some financial 'quid pro quo',and so convinced were they that some bargain would be forthcoming they began to issue bulletins to the work-force to 'condition' them for the changes (3).In early 1978 senior management at the plant began to come forward with their own proposals,assuring the Works Committee that negotiations would begin in the near future.A major element in their plans was the objective of installing a more flexible system of working on the Trim and Final Assembly tracks,involving a degree of job rotation and enlargement.Their proposed 'teamwork' method involved the abandonment of some of the specialization and job fragmentation aspects of current job design criteria in favour of employing production 'teams' which would be responsible for a whole phase of the assembly process (4).Significantly,however,the pacing and controlling element of the assembly-line would be retained such that its technical advantages would be

added to the social benefits of greater labour flexibility and improved 'attitudes' to work. Management thought that team-working methods would produce a substantial increase in productivity ; of the order of 20% in the BIW area, and 47% in Trim and Final Assembly (5). In fact, if such improvements were to be secured then some major 'change in attitudes' was vital, for the current levels of efficiency in Body and Assembly were greatly marred by production discontinuity. Figure Two illustrates this with reference to the levels of 'off standards' - the industrial engineers' measure of inefficiency.

Negotiation of change

By the summer of 1978, the Metro project team had drawn up a comprehensive list of the required changes in work practice. An internal document, 'Check list for operating requirement changes for LC8', detailed these changes, and its provisions can be summarized as follows ;

1. "To accept working within a multi-disciplined team concept where necessary."

2. "To accept responsibility for quality of own work and monitoring of previous work and liaison with inspection and rectification where possible."

3. "Full utilization of working hours." (i.e. elimination of 'block slip' and late starts/early finishes)

4. "Removal of trade demarcations." (i.e. door hanging, gas-welding and sheet metal work) (6)

These proposals make it clear that management's hopes of increasing productivity rested in large part on the dismantling of existing custom and practice. They

OFF STANDARD ANALYSIS, LONGBRIDGE BODY AND ASSEMBLY

MINI and ALLEGRO, 1977 - 1979

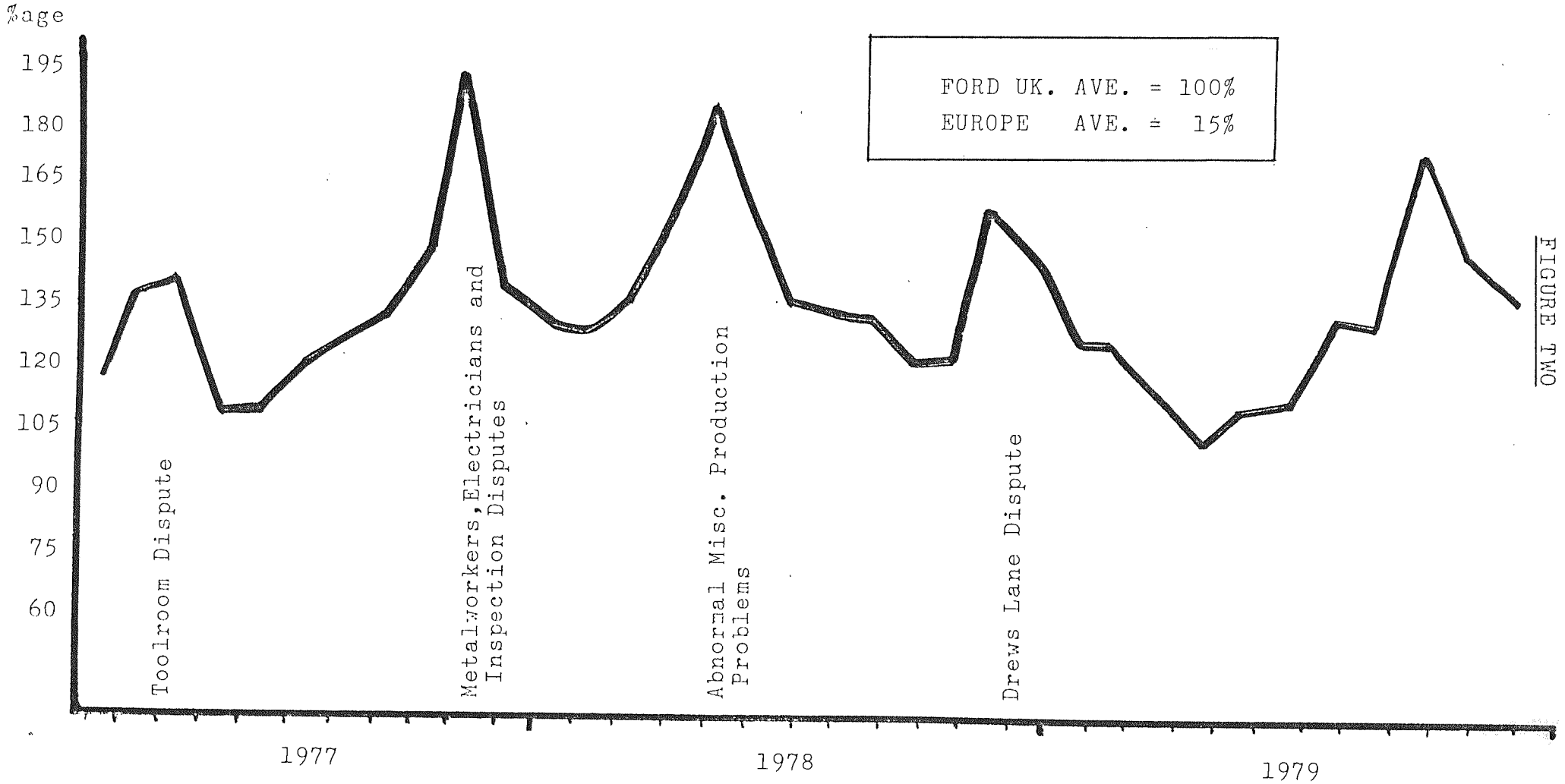


FIGURE TWO

also help to explain why management so readily embraced the team-work concept.Although their proposals were couched in the jargon of 'job enrichment',they were firmly based upon the technical advantages of increased labour flexibility.As an internal management report noted : "The design of jobs should bring about improvements in the motivation of job holders and also increase operational efficiency by increasing labour flexibility and reducing trade demarcations." (7) By making the production teams 'accept responsibility for own work', manning levels in the Quality Control function could also be reduced.Moreover,particular emphasis in the teamwork concept was placed on the role of the two or three 'adjusters' in each 20-30 strong team ; workers who would carry out 'rectification' on the assembly track itself,thereby curtailing the need for the large groups of workers engaged on minor repair tasks which had become a feature of the Longbridge plant.

The scope of the changes involved in 'team-working' together with the other items detailed in the 'Check list' document,presaged a wholesals transformation in the existing fabric of both formal and informal work rules at the Longbridge plant.At this stage management were still confident of being able to achieve such radical changes within the existing framework of collective bargaining.Indeed,during the summer of 1978 the Works Committee gave their provisional agreement to the management proposals - but strictly on the assumption

that some financial reward would be forthcoming.In the meantime,management were preparing an agreement under which the 'quid pro quo' would be financed by bringing forward the Longbridge parity payments,and consolidating them in a lump-sum payment to the work-force.One estimate put the cost of this arrangement at around £2½ million (8)

However,even as Longbridge management prepared to clinch an agreement over changes in work practices their efforts were increasingly threatened by the tide of events at company level.As BL's corporate crisis gathered momentum,the management-union accords at Longbridge were brought into question by the spreading ripples of a broader conflict.First the Longbridge talks on change had to be postponed by the introduction of parity payments throughout BL,and when negotiations did eventually begin they were coloured by a bitter conflict over BL management's decision to impose these payments unilaterally.

The Studdley talks and their aftermath

Despite the increasingly inimical atmosphere at company level,in the summer of 1979 at the secluded Studdley venue Longbridge management sought to retrieve something of their original strategy by presenting a comprehensive programme of change to be settled at plant level.The culmination of their efforts was embodied in the so-called 'Management of Change' document.It began as follows ;

> "It is agreed that in order to maintain the Longbridge Operation and protect the interests of both the Company and its employees, that significant changes in attitudes and working practices must take place...the effectiveness of the provisions will only be achieved if old attitudes and constraining customs and practices are removed." (9)

The main points of the document can be summarized thus :

1. Industrial Engineering : a 'relaxation allowance' (R.A.) of 12%.

: agreed application of Industrial Engineering techniques, with consultation but without 'mutuality' or 'status quo'.

2. Mobility : all employees to be mobile within their own grade without restriction.

: "when employees are asked to undertake higher grade work it will be regarded as training and no additional payment will be made." (10)

3. Team-working : "Each employee will..undertake any work necessary within their competence be it of a direct or indirect nature." (11)

4. Production : "It is the management responsibility to determine production levels together with the appropriate manning level." (12)

5. Quality : "If possible the work is rectified by the operator. The overriding principle is 'right first time' and the elimination of off line rectification." (13)

The proposals contained in 'Management of Change' were a collection of a number of long-standing managerial

objectives.Many of them can be traced back to management reports in 1976 and 1977 (14),and indeed many were to recur in the 'Draft Agreement' proposals of November 1979.More importantly,however,this document serves as clear proof of the importance that management attached to securing major changes in work practice prior to the launch of the Metro.Here was Longbridge management's acute perception of the need to achieve an obedient,flexible and mobile labour-force if the planned efficiency levels of the new production lines were to be secured.In that sense,they were well aware of the need to achieve labour's 'subordination to production', and equally aware that even the new technical framework in production could not secure this for them.Under the terms of 'Management of Change',management's shop-floor control of production was to extend to the unfettered determination of work standards,manning levels,labour mobility and work allocation - in other words all the parameters of production that had an important bearing on productive efficiency.

Yet,despite the radical changes in shop-floor relations and practices contained in this document,the major stumbling-block in the Studdley talks was not 'Management of Change' itself so much as its possible impact on collective bargaining at company level.Just at this time the unions within BL were demanding the installation of a new four-grade wage structure throughout the firm.Consequently,at Studdley the unions sought to pursue this aim by demanding that under the new

arrangements there should only be four grades of labour at the Longbridge plant.Even given the extent of the changes proposed,this objective became the most important matter of principle for the unions in the Studdley negotiations.

Equally if not more constrained by corporate pressures,however,were Longbridge management themselves. Although the kind of flexibility demanded by team-working might have justified the installation of a four grade structure at the plant,management were unable to accede to the trade unions' claim largely because of the forces of centralization and standardization that were operating at a corporate level.No individual plant,not even one as important as Longbridge,could be permitted to establish precedents on 'payment for change' or wage grading that might damage the evolving corporate framework of industrial relations.As one of the promoters of 'Management of Change' recognized,a plant-level agreement became an untenable proposition as soon as senior management became more concerned about 'getting the rules of the game right' across the company (15).The first victim of this determination was thus the 'Management of Change' strategy itself, for with no prospect of agreement on the wage grading issue the Studdley talks collapsed in an atmosphere of bitter recrimination.

As the new technologies and production lines were progressively installed at Longbridge,both management

and unions awaited the resolution of the work practice issue in something akin to a 'cold war' climate.. Although the unions had been prepared to make significant concessions on custom and practice,it was of central and principled concern to them that such changes should only come through agreement,and under the auspices of some 'payment for change'.Any changes imposed without their consent would in effect constitute a direct attack upon the kind of control which they exerted within the plant.Their rejection of 'Management of Change' was thus far more than a matter of money - the essential issue was power itself,in particular the unions' power at Longbridge.Aldridge notes very appositely that : "Restrictive practices are not simply attempts to get more money for less work,nor are they irrational responses...They are efforts by workers to exercise some control over features of the employment relationship."(16)

The Draft Agreement,November 1979

With less than a year to go to the launch of the Metro,the next initiative aimed at resolving the work practice issue came,predictably enough,from corporate management themselves in the so-called 'Draft Agreement' of November 1979.Although it replicated many of the features of 'Management of Change',this document was directly aimed at an unbridled resolution to industrial relations conflict throughout the company.In its 92 pages it listed a host of changes in work practice which were

intended to sweep away the entire body of custom and practice, formal and informal agreements within BL as if they had never existed. Its most important clauses read as follows :

Productivity : "full cooperation in the movement of labour to ensure the efficient continuity of production", every employee to perform any required work within their grade.

: "an introduction of sound working practices and elimination of restrictive practices which are not justified by the needs of the job, of restrictive practices and all other constraints upon operating"

Work time : "the Unions undertake to ensure that no restrictive practices will be applied to overtime, e.g. 'one in, all in', guarantee of overtime etc."

: "employees will cooperate with measures to improve the efficient utilisation of the full working shift"

Quality : "the maintenance of a high quality of work is recognised as being essential. Accordingly, it is agreed that all Employees will cooperate with existing/revised arrangements for the maintenance and improvement of quality" (17)

Apart from the details of the company's pay offer for the coming year - a 5% flat-rate increase - the main substance of the 'Draft Agreement' was in those clauses noted above which dealt with the regulation and deployment of the labour-force within BL's factories. The proposals on labour mobility, work quality and industrial engineering (the latter being examined later in the chapter) effectively embodied an uncompromising attack on the trade unions' tenure of a whole range of work rules and agreements in BL plants. Only

by suppressing trade union power at plant level could management install their own unilateral and autocratic system for controlling and regulating the labour-force.

The struggle to achieve this political objective continued throughout the winter and early spring of 1979-80, becoming intertwined with the ramifications of Derek Robinson's dismissal. Finally at the beginning of April 1980, having defeated trade union resistance at national level, BL management sought to impose the 'Draft Agreement' by instructing its employees to return to work or face the same fate as accorded Robinson. Those who returned to work under these conditions - as all the BL workers did eventually - were deemed to have accepted the terms of the document. In this way, after many years of managerial effort and countless different strategies, a coherent, company-wide, and above all autocratic system of labour relations was installed within BL.

Employment controls at Longbridge

Because of the specificity and complexity of management-worker relations at plant level, it would have been impossible for the 'Draft Agreement', even in its 92 pages, to set out in detail the changes in work practice as they applied to particular plants. Instead, the document served as a kind of 'Enabling Bill' for plant managers throughout the firm to install their own

'shopping lists' of changes - which could then be justified as 'interpretations' of the 'Draft Agreement' itself. At Longbridge, given the long historical development of custom and practice and the differences of practice between Units and even between Sections, the process of applying the document was a matter of minute detail. In Unit One (the BIW area), for instance, the production management made assiduous preparations for the imposition of the new arrangements. In an internal document, 'Implications of the introduction in changed working practices', Unit management set out their own detailed formulation of the 'Draft Agreement'. Further, the need for an almost pedantic application of new work rules was explained in the introduction to this document :

> "All employees must be informed on 9 April 1980 of our interpretation and intended implementation of the changes defined in order that his working conditions are clearly identified. If this is not done then each individual operator could legitimately claim that his interpretation of the Agreement is different from Management's thus enabling continuous disruptive action to be taken at the refutation of each contract of employment." (18)

The 'Implications' document thus reveals the intrusion of a strangely legalistic element into the day to day mechanics of industrial relations - demonstrating with some precision the extent to which BL management now based their political strength on the inequality of the employment relationship itself (19).

Not only that, but for our own purposes its admirable exactitude indirectly serves to present a detailed list of the range of work rules and arrangements which were being operated in Unit One up to April 9th 1980. These various practices can usefully be termed 'employment controls' inasmuch as they represent the control exercised by shop-floor union power over the dynamics of the employment relationship at the point of production - and are thus counterposed to the production controls exercised by management. Although the 'employment controls' in Unit One did not involve any direct intervention in the organization and methods of production, by placing limits on management's deployment of labour they constituted, in effect, the political conditions imposed by organized labour on the conduct of production. To a management desperately pursuing its own purely economic notions of efficiency such political constraints were clearly unacceptable, and the 'Implications' document singles out for special attack those 'restrictive practices' that imposed the heaviest constraint on the use of labour.

Its extensive list can be briefly outlined as follows :

'Slipping' : in Unit One the stewards had pressured management into conceding that 'block slip' would not be altered to 'full slip' until lunchtime on the day shift. The effect was said to be "inefficient use of manpower and adverse effects on production targets" (20)

Mobility : under previous Longbridge agreements mobility of labour had been subject to a number of limitations.Most importantly,there was to be no mobility between Units,and any transfer of workers was conditional on the agreement of the shop steward involved."Effect : loss of production - inefficient use of labour - overmanning." (21)

Demarcations : Unit One contained the only formally recognized demarcation lines for 'direct' workers on the Longbridge site.The Longbridge procedure agreement of March 1976 detailed the demarcations as follows ;

> "It is recognized that the only area where demarcation exists is limited to the West Works where :
> a)Operators on the following jobs are represented by the Sheet Metal Workers' Union : Lead Loading,Planishing,Sheet Metal Finishing and Production Gas Welding.
> b)Operators on the following jobs are represented by the Transport and General Workers' Union (Auto)..: Door hanging and Boot-lid fitting." (22)

The restriction on sheet metal work (the smoothing down and finishing operations on the 'Body In White') was the most important of the two demarcations,since it limited these tasks to the well-organized and cohesive ranks of the thousand or so card-carrying Sheet Metal workers at Longbridge.For management it not only limited mobility and caused overmanning (by needing to have reserves of Sheet Metal workers to replace the sick or absent) it was also viewed as a source of inter-union rivalry and tension.

Industrial Engineering

Although all of the above-mentioned practices represented important obstacles to the managerial version of efficiency, perhaps the most important of the constraints imposed by the unions were those which placed some limit on the Industrial Engineering function. As the installation of MDW in BL plants had shown, the introduction of a new system of industrial relations counted for nothing unless management had the freedom to both measure and implement 'efficient' work standards in production.

Prior to the installation of the 'Draft Agreement' management in Unit One had been forced, as the 'Implications' document ruefully notes, to accept a number of constraints in this area. For example, the ability of the Industrial Engineering (I.E.) function to carry out work measurement was strictly limited :

> "Restricted access after consultation and then only when accompanied by shop steward from each shift.
> Effect : Waste of I.E. resource, ineffective use of plant, and labour problems over the introduction of new or changed methods of working." (23)

Further, even when work standards had been measured there were major problems in applying them :

> "Protracted procedure on disputed standards and status-quo applies until situation is resolved.
> Effect : Delay in implementing efficient work standards and methods." (24)

But the impact of shop-floor union power was not confined to the restraints placed on the process of industrial

engineering.For,by a combination of collective pressure and appeals to the dilapidated state of the Old West factory,the Unit One shop stewards had succeeded in pushing up the level of 'Relaxation Allowance' in their area to 17% - higher than almost any other part of the Longbridge plant.

It was exactly this kind of obstacle to management's control of production that formed the object of the Draft Agreement's attack.In contrast to the 'mutuality' on industrial engineering that was exemplified by the Unit One practices,the Draft Agreement would only allow that the trade unions be 'fully informed' and 'involved' in industrial engineering studies.The Agreement effectively secured a predominant shop-floor role for the Industrial Engineering function by imposing the unilateral determination of work standards :

> "In establishing work standards,it is accepted that the Unions and their members will cooperate to the full..Standard times are not a matter for negotiation." (25)

At Longbridge these provisions were crucial to the plant management's attack on existing custom and practice.Not only did they eliminate any obstacles to the application of industrial engineering,but they also established the 'tabula rasa' on which a new,more efficient pattern of work standards could be drawn.However, even as they aided Longbridge management achieve better operational performance,the provisions on industrial engineering also served the strategic purposes of BL's senior management by furthering the centralizing and

standardizing tendencies within the firm.

It was more than six years since work standards had been subject to any major revision at Longbridge - and even that had been associated with the launch of the Allegro in 1973 when 'mutuality' was still in force. The installation of the new facilities for the Metro thus provided the industrial engineers with an ideal opprtunity to make good the mistakes of 1973 and install more rigorous standards.Of equal significance,however, was the fact that the launch of the Metro permitted the implementation of the 'corporate' schema of work standards and allowances : since 1973 plants such as Llanelli, Swindon and Cowley had all come under the sway of corporate industrial engineering policy,so the launch of the Metro provided the occasion for applying standards which until then had only been a comparative 'yardstick' (26).As a senior industrial engineer put it ; "The Metro is the vehicle for introducing corporate I.E. policies - that was the aim right from the word go." (27)

The effect of the Draft Agreement with regard to industrial engineering was thus two-fold in character. First,it rendered the Industrial Engineering function a much more powerful instrument in the struggle to improve labour productivity at plant level.Second,it acted to undermine the local autonomy previously enjoyed by plant management,tightening the link between individual plants and corporate policies and strategies.Now Longbridge management themselves would be that much more answerable to company-wide,and hence easily comparable,standards of

industrial engineering.The attainment of both these operational and strategic objectives,however,depended quite clearly on the imposition and maintenance of a new order of power relations in BL plants - in effect a 'new regime'.

The new regime

"It all boils down to what you can get away with. It always has.It's based on power." - Industrial Relations Manager,Longbridge (28)

The period after the imposition of the Draft Agreement at Longbridge was marked by a transformation in the system of industrial relations at the plant.A succession of management victories - notably over the dismissal of Derek Robinson and then over the Agreement itself - served to bring about a major shift in the power relations between management and unions.Although there were exceptions,by and large the Draft Agreement became the basis for the conduct of industrial relations throughout the Longbridge site.Shop stewards were deprived of even the merest consultative role over the transfer of labour and overtime requests.In almost every area joint regulation,'mutuality' and compromise were replaced by unilateral management control.

Between April and October 1980 the new political economy of the Longbridge plant found expression not only in the collective bargaining balance of power,but also at the most microscopic level of shop-floor social

relations.In their control and deployment of the labour-force,production management adopted an autocratic style, using the Draft Agreement as their justification for riding roughshod over job rights,agreements and informal understandings alike.In Unit One,the Industrial Relations Manager spoke of 'maintaining and policing' the new work practices,and the latter word seems to define the new management style quite succinctly(29).

Perhaps the greatest amount of managerial concern was focussed upon Unit One itself,and in particular the New West factory with its array of new technologies.Here management sought to exploit to the full the 'green-field' possibilities of the new factory.The Industrial Relations Manager of Unit One was well aware that the gradual build-up of production in the New West would allow management a useful margin of time in which to instill and develop the right 'attitudes' amongst the work-force. He began by establishing a rigorous process of selection for men transferred from the older parts of the plant. Only those with the right skills and 'character' were selected for transfer.For example,much of the initial intake of workers came from a labour surplus in the Powertrain areas of Longbridge,but of the 118 Power-train workers interviewed for transfer in June 1980 only 64 were selected - that is,just over 50%.(30).

When the new intake of workers actually arrived in the BIW factory,they were further subject to managerial pressures,as management sought to exert an influence

over the behaviour of their small work-groups.As the Industrial Relations Manager explained ; "It is far easier with a small group to condition and influence their thinking." (31) The kind of 'conditioning' that management sought was clearly antipathetic to union organization.In April 1980,for example,when the New West work-force refrained from taking part in a major dispute centred on the Old West,the Unit One Industrial Relations Report commented with mild satisfaction that this was "a general attitude...which if encouraged can only ensure the success of the Metro" (32).Instead of only a formal or negotiated control over the work-force,management in the new factory pressed for direct 'communications' at shop-floor level."Ideally" said the Industrial Relations Manager "you would have direct contact between management and workers" (33) Further,the fact that the 'pre-production' programme of the Metro required only relatively small numbers of workers in the new factory allowed management and supervision to apply this ideal fully.As a result the new political balance within the Longbridge site was directly translated into personal relationships on the shop-floor.One of the production foremen,for instance,commented that "work practices are a matter of personalities" (34).And he went on to describe what this meant in practice ; "We can move workers about anywhere now.We have them sorting out scrap and cleaning up their section." (35)

Along with the attempts to shape the 'attitudes'

of the work-force went a more explicitly political effort to exclude the Works Committee and the trade unions from exerting any control or influence over events in the New West.Previously,Unit One had been one of the most conflict-ridden areas of the plant - one member of its Industrial Relations management reported two or three stoppages a day in the Old West,together with a high frequency of dismissals and disciplinary hearings (36).This record of conflict,when added to the critical significance of the new BIW factory itself, helps to explain why management were anxious to curtail the extension of trade union influence over the New West.They sought to do this,firstly,by dismantling the active and troublesome Unit committee of shop stewards.Although this was in accord with a general policy adopted throughout Longbridge of limiting the power of the various Unit committees,Unit One management seem to have been especially vigorous in a policy of "pushing the Unit committee down" (37).The previously semi-permanent existence of the committee was terminated, and its members were returned to their normal jobs. Henceforth the Unit committee was to meet only when requested by management,or when required by procedure. While this move actually received support from local A.E.U. officials outside the plant (they also supported the Draft Agreement) (38),it was clearly damaging and calculatedly so to the trade union organization at Longbridge in the months leading up to the launch of the Metro.

All of this applied with even greater force to the New West itself,where the effort to eliminate the trade unions as a day to day restraining influence upon management was extended even to an attempt to prevent the election of shop stewards in the new factory.By forestalling such elections,management were able to claim for a time that the Works Committee's influence did not extend to the New West.

But despite the efforts that were made in the 'pilot' and 'pre-production' period of the spring and summer of 1980,by September and October of that year it was clear that management had failed to secure a completely malleable work-force in the New West.As the number of workers transferred to the new plant became too large to be effectively controlled by management, the former cosiness of management-worker relations quickly evaporated.According to one of the production foremen,the problem was that; "You can't hand-pick them any more and sooner or later you start to get trouble-makers."(39) In fact,by the end of October 1980 around 20 stewards had been elected from the 1200 workers in the plant,and some kind of shop-floor union organization had been established.Nevertheless,the Unit Industrial Relations Manager continued to foster hopes of being able to mould or manipulate the evolving union organization,to,in his words,"influence them towards my own way of thinking,my view of discipline" (40).

The signficance of this continued,if diminished,

resistance to managerial autocracy is that it demonstrates more clearly than anything else management's failure to achieve any kind of 'revolution in attitudes' on the part of the work-force.Moreover,this groundswell of opposition meant that the supposedly technical content of industrial engineering continued to be highly coloured by political considerations.In implementing the critical parameters of production in the New West - manning levels,work standards,and so on - the industrial engineers were especially aware of the political element of their new role.Their hope of 'screwing in tight standards' on the new facilities was further reinforced in the New West by their ability to install the major parameters before the large-scale transfer of workers took place.With the foremen 'clued up' as to what was required in the new factory,production management raised the line-speed on the BIW finishing tracks to 25 cars per hour some time before the influx of workers from the Old West (or "before the rabble arrived" as one production manager put it (41)).

Then in June 1980 after a politically expedient delay,the industrial engineers finally succeeded in implementing the new corporate work standards throughout Unit One.The most important effect of this move was that the Relaxation Allowance in the Unit was reduced from 17% to the corporate 12%,entailing the elimination of agreed rest-periods (42) and the abolition of late starts and early finishes for production workers. The result was an absolute increase in work time - from

72.6 hours per week (over two shifts) to 78 hours,with production running from 'bell to bell'.This change brought an immediate increase in labour productivity of around 7% - achieved without any cost to management, only to the labour-force.

Trade union response

Although the Works Committee had succeeded in establishing some kind of union presence on the new facilities,overall there was surprisingly little active trade union opposition to the scale of changes introduced by management at Longbridge.In part this lack of response can be attributed to the prevailing mood throughout BL,with the trade unions on the retreat in the face of an uncompromising management.At Longbridge, however,certain specific factors combined to further undermine the union position.Since the dismissal of Derek Robinson,trade union organization at the plant had been in a state of disarray,and added to this there was little fighting spirit amongst the rank-and-file workers.As the local T+G.W.U. official commented ; "The morale of our members is at an all-time low." (43) And a shop-steward on the Trim and Final Assembly lines claimed ; "Most of them are just waiting for their redundancy money." (44)

It was not that the unions had entirely submitted to management diktat.Indeed there was considerable but isolated resistance to the Draft Agreement in certain

parts of the plant,and the official Works Committee position was still one of resistance to the Agreement. Or,as Jack Adams put it ; "You can come in with hob-nail boots or you can come in with carpet slippers and the wings of a dove,and you've still got problems over that agreement." (45) However,even if the unions' political weakness had not prevented this from being little more than a rhetorical position,the pressures associated with the Metro's launch certainly would have done so.For,with the new model playing such a critical role in BL's prospects of survival,in the months leading up to its launch the unions at Longbridge deliberately sought to avoid embroiling it in any of the Draft Agreement conflict.As Jack Adams said ; "Whatever the problems we have in the plant,we recognize the priority of the Metro.We have done everything possible to accomodate the Metro." (46) Thus,while there were disputes in the Trim and Final Assembly area over labour mobility,and in the New West itself over the provision of lockers,these minor flare-ups were comparatively trivial in character,with the unions cooperating in management's aim of 'putting on our best face' for the launch of the new model.

However,while these factors combined to render the trade unions relatively quiescent during the launch period,the general victory of management control on the shop-floor concealed many specific issues in which they were unsuccessful.For example,a strike by the CO2 welders and linishers in the Old West forced the

re-instatement of their 'dress-up/clean-up' allowance. Perhaps the most important of such instances of managerial failure in the months prior to the Metro's launch is the example of the Sheet Metal Workers' demarcation, which,as we mentioned earlier,was one of the specific objects of managerial attack in the 'Implications' document.

The Demarcation

The demarcation-line which allocated all the sheet-metal finishing work on the New West's production lines to the Sheet Metal Workers' Union was regarded as one of the most important constraints on the efficient deployment of the BIW labour-force.Moreover,unlike other groups who were more directly affected by the new technology,the Sheet Metal workers' tasks were little affected by the mechanization within the BIW process,since that was largely confined to the spot-welding area (47).Consequently,there was little possibility for management to conceal or incorporate their attack on the demarcation within the processes of technological change.The resulting political salience of the issue is usefully indicated by its recurring inclusion in managerial proposals on work practice changes : it was selected as a target as early as July 1978 in the internal 'Check list' document,and the subsequent Unit One 'Implications' report outlined the complete abolition of the demarcation-line.Under its

proposals the only determining factor in labour deployment was to be the 'capability of the operator' (48).

But while the other provisions of that document were speedily put into practice after April 1980, the cohesion and strategic power of the Sheet Metal workers - controlling a whole phase of the production process - had the effect of deterring Unit One management from simply proceeding with the abolition of the demarcation. Instead, a more gradualist approach was adopted with the Industrial Relations Manager commenting in July 1980 ; "We are slowly building up towards breaking the demarcation." (49) Management's determination to resolve the issue remained firm, however. Indeed the fact that the demarcation created a number of problems in the recruitment of sufficient Sheet Metal workers for the new production lines only added to the managerial resolve (50). As the June Industrial Relations Report from Unit One noted, the shortage of skilled labour was a matter of increasing concern: "Much time and effort has been spent in overcoming the critical shortage of Sheet Metal workers for the launch of the Metro." (51)

But paradoxically, in a strange parallel with events at company level, Unit management were able to turn this apparent weakness into a bargaining lever to be used against the union involved. In the knowledge of the overriding importance that was attached to the Metro, Unit One Industrial Relations management were able to come to an 'understanding' with the officials of the Sheet

Metal Workers' Union.As the June Industrial Relations Report notes,

> "Various meetings have been held with the Trade Unions culminating in a meeting with Sheet Metal Work Union officials at Eastbourne (location of their annual conference).Following which an understanding was reached on our ability to train auxiliary card-holders,and a concession on Company policy given which has enabled the recruitment of ex-British Leyland employees who have been made redundant." (52)

Despite the 'concession' on the recruitment of redundant Sheet Metal workers,it seems clear that this understanding represented somewhat of a coup for Longbridge management.Previously the 'auxiliary card-holders' had been restricted to carrying out CO2 welding only,and consequently the extension of their scope into a broader range of sheet metal tasks brought the whole demarcation into question.Even the local Sheet Metal Workers' official,who was closely involved in producing the 'understanding',accepted its political sensitivity.He admitted ; "Some agreements have to be verbal." (53) Of course,the political impact of the new arrangement was entirely in line with managerial intentions.The Industrial Relations Manager explained that as soon as the 'understanding' had proved to be inadequate to the New West's needs,management would use it as the further justification for undermining the Sheet Metal demarcation line : "Then we can say,'Look we've done our best,we've exploited every avenue,the demarcation will have to go'." (54)

Yet,in the face of this increasingly overt attack

the local Sheet Metal official maintained an uncompromisingly complacent attitude, claiming that his members' position was securely founded upon the possession of certain vital skills ; "BL cannot produce a perfect panel, so my members will always be needed." (55) However, this view hardly seems tenable in the light of management's intentions and their preparedness to train up auxiliary card-holders.

As the October launch-date approached, Unit management sought to profit from their earlier successful efforts at eroding the demarcation and began to increase the pressure on the Sheet Metal workers' organization. In September 1980 they began the next phase of their attack on the demarcation. This time they asked for a 'dispensation' to train 50 non-Sheet Metal card-holders to carry out certain limited tasks on the finishing lines. Once again the Sheet Metal Union officials were cajoled into appeasing the 'needs' of production, and in this they were even able to gain the support of the leading Sheet Metal stewards in accepting the 'dispensation'. However, on this occasion management's ploy of exploiting the union officialdom was to be determinedly resisted. At a mass-meeting of all the Longbridge Sheet Metal shop stewards, the management proposal was soundly rejected on the grounds that it involved the introduction of 'dilutees' - that is, unskilled, non-Sheet Metal labour - into Sheet Metal

tasks.As the September Industrial Relations Report described the situation ;

> "Further discussions on the recruitment of Sheet Metal Workers resulted in the officials meeting first the Central Committee and then the shop stewards involved in an attempt to reach some agreement over what the Trade Unions view as dilutees. The Sheet Metal Workers' Central Committee who are seen as the inner circle of Shop Stewards agreed the principle of training the non Sheet Metal Worker card holders up as Sheet Metal Workers,but a meeting of the Shop Stewards rejected this." (56)

With this important rebuff to managerial intentions, the launch of the Metro in October 1980 saw Unit One management still trying to resolve the demarcation issue.Their earlier success now took on the character of the first battle in a long campaign,in that all their subsequent efforts had only managed to produce an uneasy compromise on this question.Ultimately,neither the formal provisions of the Draft Agreement,nor covert 'back-room' arrangements,could completely prevail over a group of workers who were well-organized,powerful and determined to defend their job rights.Thus,against all the trends at Longbridge,the example of the Sheet Metal Workers' demarcation serves as a useful illustration of the way in which collective strength can at times stand firm against both the fluctuating currents of technological change and the political machinations of management.As Hobsbawm rightly notes of technological change in industry ; "labour-saving devices do not..automatically dislodge key groups of workers from their strongholds.They do so only when such

groups are unable to maintain their relative indispensability during the crucial transition period." (57)

Conclusion

If there is any single element of the foregoing account which seems especially significant it is the critical importance which was attached to the pursuit of radical changes in work practices and standards in the period preceding the launch of the Metro. As if to reinforce our earlier point that the 'subordination of labour to production' was a crucial aspect of technological change, management at Longbridge from 1976 onwards made persistent and in the end largely successful efforts to make sure that their own definition of efficiency was installed in the work practices and work standards of the new Metro lines. In the process their efforts served to reveal the great variability and flexibility of management strategy in pursuit of such a goal ; ranging from the initial plant-based 'Management of Change' strategy which attempted to achieve radical change by a combination of persuasion, participation and negotiation, to the opposite extreme of the corporate-level 'Draft Agreement' strategy which sought to achieve union acquiescence by the application of brute force.

Moreover, while management and unions were engaged in this broad political struggle for control, their conflict was reflected in the detail of production by the mutual antagonism between the job rights and practices of the Longbridge work-force - their 'employment

controls' as they were termed earlier - and the role played by the Industrial Engineering function.At this level,management's concern that the new facilities and technologies be operated at planned levels of efficiency (entailing higher levels of effort from the work-force) found clear expression in a deliberate and uncompromising attack on any existing custom and practice in the Longbridge site which stood as an obstacle to this end.

Management were not always successful in this objective of course,with the example of the Sheet Metal workers serving as proof that collective power may at times prevail over managerial values,even when the latter are embodied in a massive programme of technological change.Yet,it is important to note that the kind of control which the Sheet Metal workers were able to secure was of a purely protective sort,reinforcing the general point made by Elliott that "what control workers do exert over technology tends to be of a defensive and negative kind" (58).Indeed,the comparative success of groups such as the Sheet Metal workers cannot disguise the fact that,by and large,management in this period were able introduce and install new levels of productive efficiency on the shop-floor.

Their achievements in this regard can be attributed in large part to their political victory within BL as a whole in imposing the Draft Agreement against the concerted resistance of the trade unions.But added to this was the important fact that the Longbridge Works Committee,just as much as the Sheet Metal Workers'

official discussed earlier,were prepared to acquiesce in managerial objectives for the short-term in order to secure the long-term success of the Metro,and thus indirectly the survival of BL itself.To a degree this meant that the unions were prepared to tolerate what had formerly been intolerable,and to deliberately refrain from using their considerable disruptive power to threaten the Metro project - even if this meant neglecting to protect the interests of certain groups of workers (59).They thus placed themselves quite clearly in the kind of position described by Herding,where "pursuing labor's long-term interests within an accepted capitalist economy means to abide by the economic rules of the system,and thus,if necessary,to suppress the 'short sighted' demands voiced by the grass roots" (60).

In terms of management's ability to impose new work practices and standards on the shop-floor,this particular,fundamental aspect of the work-force's 'subordination to production' was a critical factor.For, only upon the basis of the 'priority' accorded the Metro by the Works Committee could management have been so successful in translating their political regime in the plant into new,higher levels of productivity and efficiency on the Metro production lines.Moreover,the crucial contribution of the changes in work practice to the economic efficiency of the new Metro technologies was later given retrospective acknowledgement by the Managing Director (Operations) of Austin Morris,Mr.

Andrew Barr.He estimated that of the improvement in productivity after the launch of the Metro (see Figure Three) up to 85% was attributable simply to more efficient working arrangements,with the technology itself playing a comparatively minor role (61).This claim not only underlines the importance of the management-union struggles of the pre-launch period,but also reinforces the view that the close intertwining of technological change with the power relations of the plant,far from being simply the result of an especially conflict-ridden pattern of industrial relations,was actually intrinsic to the Metro project's strategic economic objectives.

Finally,one noteworthy feature of this chapter which has not been touched upon so far is the absence of any detailed reference to the BIW technologies of the New West.Although at first sight this may seem somewhat surprising in view of the radical character of the changes in technology,in large part it can be explained by the simple fact that the new technologies had little direct impact upon the production work-force with whom this chapter has been concerned (62).Having little if any skill or craft within the production process,this mainly unskilled group of workers had little vested interest to protect or advance in the process of technological change.Rather their interests and control lay in the intricate pattern of job rights and custom and practice which had been consolidated not through

any technical expertise but by collective power.Even to a group like the Sheet Metal workers with some pretensions towards skill,the major principle at stake in this period was one of protecting their collective control of work against a managerial strategy which sought to solve BL's problems by coercion and the removal of 'restrictive practices'.

But while the question of skill was of only marginal importance to the largely de-skilled production workers,this was not the case with every group of workers in the plant,and the following chapter will be concerned with one important group to whom skills and their protection were of vital significance.

CHAPTER NINE

NEW TECHNOLOGY AND THE MAINTENANCE TRADES

Introduction

It was noted earlier that the choice of a highly automated BIW process for the Metro was largely the result of strategic considerations.However,one major aspect of the design process was management's concern for the maintenance problems of such an automated and integrated process.Indeed,from the very inception of the AD088/Metro project the role and behaviour of the maintenance function in the new plant had been identified as an important focus for management's attention. Management counterposed BL's lack of the relevant skills and experience with the imperative need for continuity in such a highly integrated system,and thus placed great significance on the effectiveness of the maintenance trades in the New West.The greater part of this chapter is to do with the many and varied attempts made by management to ensure that a suitably trained and responsive maintenance work-force was installed in the new plant.Initially,however,the attempt to resolve certain of these maintenance problems was incorporated within the BIW design itself.

Design for maintenance

In designing the new BIW plant, BL's engineers saw it as a major part of their task to ensure that their design should as far as possible either minimize the maintenance requirements of the new facilities, or at least facilitate the maintenance task and render it less critical to the general flow of production. Their efforts were thus basically three-fold in character.

Their first concern was with measures that would prevent or pre-empt the need for maintenance in the new plant. Not only did this involve, as was noted earlier, a high priority being placed on the technical reliability of the various 'body-framing' options available to BL, but it also found expression at a more detailed level in the choice of technologies. The decision to employ 'Unimate' robots in the ABF process, for example, was in large part the result of their long record of applications in the motor-industry, and a general belief that they were a more proven technology than their competitors. Added to this factor, BL's engineers were able to reduce the role of the Longbridge trades groups in the programming of the Unimate robots : they did this by contracting out the basic programming tasks to the suppliers, leaving the tradesmen with the responsibility for only piecemeal modifications to the original programmes.

A second major aspect of the BIW facilities was

the incorporation of a number of features aimed at minimizing the disruptive effects of machine failure. Mindful of the BIW process's vulnerability to machine breakdowns, the BL engineers saw to it that the layout of the conveyor systems in the new plant was closely oriented to the aim of providing extensive 'buffer stores' between the major sub-processes. Moreover, when the stocks of sub-assemblies held in the conveyor systems were added to the contents of specialized stores such as the Tagged Body Store containing 177 'tagged' bodies, they effectively provided the total of 1½ to 2 hours supply of parts to each major sub-process which the BIW engineers had established as a design objective. In fact, within the most important of the sub-assembly processes, additional precautions were taken in the form of, for example, internal buffer stores on the Kuka Underframe machines, or the two robots at the end of each ABF line which could could serve as substitutes in case of breakdowns.

Thirdly, the BIW engineers introduced many extensive features aimed at facilitating maintenance of the new facilities. They made a particular effort, for instance, to exploit the possibilities of mechanical interchangeability and 'modularity' in their design, such that many of the machines in the New West comprised modular, easily replaceable components (1). In addition, they sought to ensure the speediest possible diagnosis of machine problems by the provision of diagnostic aids such as

'optic boards' (2),and a far-flung network of 'facility monitoring' devices.

The tangible results of the BIW engineers efforts were thus incorporated in a number of the technical features of the New West plant.However,one important,and not entirely accidental consequence of their choice of technologies was the clearly non-technical effect of the down-grading in the skills needed to maintain and service the new facilities.In accord with what seems to have been a pervasive concern amongst BL's production engineers to minimize the skill requirements of its maintenance workers,the BIW engineers built into their design a number of technical refinements aimed at keeping the necessary skills at the lowest possible level.

Nowhere was this aim better displayed than in the choice of PLCs (Programmable Logic Controllers) to carry out the most important controlling and monitoring tasks within the BIW process (3).This critical choice seems to have been heavily influenced by a perceived need to minimize the maintenance requirements of the new production lines.Indeed,while the technological trends within the industry were favouring control systems based on a central computer (4),the decision to opt for PLCs was consciously directed towards the goal of securing both the greatest operational reliability and the lowest level of maintenance skill.

Their intentions reinforced by previous unhappy experience with sophisticated electronic controls, the BIW engineers decided to opt for the simple but functional PLC technology in the belief that it would prove more compatible with BL's existing maintenance skills (5). Certainly, PLCs offered a number of distinct advantages in this area. For example, unlike a centralized, computer-based system, the failure of individual PLCs within the distributed network could be quite easily monitored and rectified. In addition, PLCs offered the easier and much less complicated adjustment of welding parameters (cycle times, resistances etc.). But most important of all, however, was the fact that PLCs demanded only a comparatively low level of skill from the maintenance function. Each PLC's diagnostic system, for example, could be utilized at any one of three different levels depending on the type and extent of the fault :

Level One ; optic boards display status of inputs and outputs to PLC.

Level Two ; programming panel on the PLC's VDU (visual display unit) attachment displays a conventional 'ladder diagram' indicating at what point circuit broken.

Level Three ; control programme in PLC analyses operation sequence and indicates location of fault. (6)

Moreover, unlike computerized systems, the PLCs were based upon relatively simple programming techniques, and

were therefore much more accessible to maintenance workers without any advanced electronics training. Indeed, the suppliers of the PLCs used by BL chose to highlight this aspect of their product as one of its greatest selling points. In an advertisement they claimed that their PLC had "the ability to operate in industrial environments, to interface directly with the machine or process and, perhaps most important, to be programmed in simple language familiar to shop-floor personnel" (7) (my emphasis). Given this kind of technical simplicity, the PLC made few additional demands on the skills of the Longbridge maintenance tradesmen. In fact, one senior BL engineer estimated that electricians of average ability ought to be capable of making good use of the PLCs within just two months of beginning to work with them (8).

Technology and skill

Despite their deliberate and systematic efforts to down-grade the skill requirements of the new BIW process, within a few months of the start of production operations in the New West it became apparent that the BL engineers had been far from completely successful in their aims. Many of the technical features which had been designed to reduce maintenance needs were soon negated by a combination of unforeseen operational demands and simple technical unreliability.

In the case of PLCs, for example, it was quickly

discovered that,for all their supposed reliability,this technology was subject to a high frequency of 'infantile failure' - with both the New West and the Trim and Final Assembly tracks being affected by this problem.Moreover, even the Unimate robots,which were accepted as being relatively proven,eventually developed a number of mechanical and hydraulic problems.Not only did this involve the trades groups in much more re-programming work than originally anticipated,but management were also forced to resort to the 'cannibalization' of the 2 stand-by robots at the end of each line,in order to provide replacement parts for the remaining 24 robots. As a result,the ABF lines effectively lost any element of design 'redundancy' and the breakdown of a single robot became a critical event.(9).

All of this serves to underline the crucial distinction between managerial objectives as embodied in the process of design,and the practical problems of securing those objectives in production.It seems that de-skilling strategies may often be contradicted by the very technologies that they employ - serving only,as in this case,to render the maintenance function more and not less important within the production process.

More generally,however,the rebuttal of certain of management's design objectives for the BIW process effectively demonstrates the intrinsic uncertainty associated with even the most automated production systems.As Crozier notes,it may well be the case that in

a highly programmed production system,"machine stoppages are the only major happenings that cannot be predicted and to which impersonal rulings cannot apply" (10). Further,inasmuch as,in Woodward's words,"the amount of uncertainty in an organizational task is a major determinant of the way that the task can be controlled",(11) the nature of the maintenance group's work seems bound to enhance their autonomy and freedom from managerial control.It also follows that the maintenance function's control of uncertainty within production - their skills and their control of the repair process for machine failure - affords them a strategic power which few other work-groups possess.This kind of power is clearly antithetical to management's control of production,and hence seems to provide the explanation for many of the managerial efforts to down-grade the skill requirements of the new plant.

But if the intrinsic character of the Longbridge maintenance trades role in the New West provided them with a degree of freedom from managerial or technological control,it offered no automatic immunity from the broader form of 'subordination to production'.That is,their skills alone could not guarantee the security of their collective interest against managerial values and objectives.Rather,with the distribution of uncertainty ultimately depending,as Clegg notes,on the political structure within the organization (12),to secure their position the trades needed to deploy their

strategic power deliberately and to some purpose.In particular,in the years leading up to the launch of the Metro,the Longbridge trades needed to ensure that their own interests were not jeopardized by or subordinated to the emerging version of efficiency which management sought to install in the new facilities.

The maintenance trades and efficiency

Management's initial efforts to secure an efficient,well-trained maintenance function in the New West centred on the need to define and inculcate a new set of skills,more appropriate to automated facilities,in their maintenance work-force.However, given the character of maintenance work,the determination of such skills and their distribution eventually proved as much a matter of political as technical considerations.

It was obvious from the inception of the AD088/Metro project,for example,that new electronic skills would be needed in maintenance.Yet there were no direct or objective pointers as to exactly what kind and level of expertise would be required.Nor,more importantly,was there any objective way of defining the optimal or 'necessary' distribution of such skills.Although the suppliers of the new BIW technologies put forward their own suggestions as to the level of expertise needed, their proposals were little more than rough estimates, and in certain cases were rejected by BL management as

being unrealistic or inflated (13).

On the other hand, management's attempt to pursue the example set by other manufacturers only underlined the point that the work organization and skills of the maintenance function were as much the result of a particular set of management-worker relationships as a function of the technology employed. For instance, BL management, aware of Fiat's extensive experience with automated systems, tried to learn from the example set by that firm, and not only dispatched a team from the AD088 sub-committee to investigate the Mirafiori plant, but also based a number of management reports upon the Fiat experience. Yet, the findings of such investigations only served to emphasize the fact that the differences between BL and Fiat were just as much to do with different social relations on the shop-floor as with variations in technology. At Fiat, management had been able to install a maintenance organization where, to quote from a BL report, "maintenance is organized on the principle that the determinant of the allocation of responsibility for a particular fault is not the type of fault but the complexity and length of time to rectify" (14). As an important part of this organization, Fiat also operated a 'two-trade' system of maintenance, with only two major trades - Mechnical and Electrical - being involved in machine repair.

In direct contrast, BL's breakdown maintenance like

the rest of the maintenance function was based upon the trade organization of the maintenance workers themselves. A total of five different trade groups might be called in to a major repair task,with each tradesman contributing from his own specialized experience as an electrician, or machine-tool fitter,or pipefitter,and so on.Further, given that at BL maintenance skills and organization were so deeply rooted in the collective craft organization of the work-force - and not contingent on the technology as at Fiat - the relationship between skills and technology was to a large extent under the control of the tradesmen themselves.Consequently,there could be no automatic adjustment of the social organization of maintenance to the new technological order in the BIW process.

Thus,while the example set by other firms could serve to indicate the general level of skill and training needed in the new facilities,the maintenance problem for management remained at bottom a political rather than a purely technical one.Whatever the ideal solutions posited by management,the achievement of planned efficiencies in the New West depended upon the outcomes and practical accomodations achieved in a political struggle with the trades groups.

Management strategies

The first step in the process of securing the new maintenance skills and work organization at Longbridge

was taken in July 1978 when the project management team drew up a list of changes in maintenance work practices - the 'Check list for operating requirement changes for LC8'.The contents of this list clearly reveals the extent to which BL management had assimilated the Fiat example,for it includes the following four major items all of which were elements of Fiat's maintenance organization.

Two-trade maintenance : under this proposal the maintenance function in the New West would comprise only two trades - Electrical/Electronic and Mechanical - as against the seven different trades currently employed for maintenance (Millwrights,Electricians,Pipefitters, Machine Tool Fitters,Jig and Tool Fitters,Toolroom, Maintenance Fitters).The adoption of two-trade maintenance, which was typical of many other continental producers apart from Fiat,entailed a reduction in the maintenance manning levels and a consolidation of skills in the mechanical trades.

'On-line' maintenance : instead of the maintenance trades being grouped together in a central,off-line pen within the factory,the breakdown maintenance teams were to be stationed in 'on-line' pens,actually alongside the machines and conveyors for which they were to be responsible (15).The aim of this practice was that the maintenance teams should be immediately available in case of machine breakdown,and being 'self-motivated' would respond directly to production problems.The importance of this aim can be gauged from the Fiat

estimate that 90% of their maintenance problems were dealt with by the on-line teams (16).

Supervision : the on-line tradesmen were to operate under the command of production supervision, rather than, as previously, their own maintenance supervisors. This proposal, which was entirely novel in the context of Longbridge, implied a significant reduction in the traditional autonomy of the maintenance function.

Shift arrangements : in order to provide for a period of planned and preventive maintenance after the production shifts - this being thought indispensable to the operations of a highly automated process - management planned to introduce a continental, three-shift system of maintenance.

The critical importance of achieving such practices was further emphasized by a study carried out by BL's Industrial Engineers. This found that even for the repair of existing manual spot-welding systems, the efficiency of the Longbridge maintenance function was woefully inadequate. The average 'downtime' before repair of a welding gun at Longbridge was twelve minutes - against 2 minutes at Cowley - and this slowness of response was largely attributable to the off-line location of the maintenance trades and over-elaborate lines of communication (17).

The prevailing deficiencies of the maintenance function served to highlight the ambitious nature of the levels of production efficiency planned for the New

West.Since the overall target of 80% machine efficiency represented not only the technical basis for the coordination of the BIW systems,but also a formulation of the production continuity needed to achieve anticipated returns on the capital investment,it assumed a vital significance.Moreover,with one estimate suggesting that the efficiency levels of the New West might be down-graded by as much as 20% if conventional trade practices were allowed to prevail,management's pressing concern for change becomes understandable (18).

However,although adoption of the Fiat model could be justified by reference to that firm's automated or advanced technology,radical changes in maintenance skills and organization could not be secured by the new technology per se.Instead,it depended on management's ability to manipulate what was effectively a three-cornered situation in which technology and efficiency were counterposed to the collective organization and interests of the trade groups.In particular,management's success in installing their own standards of efficiency in the operations of the maintenance group rested upon the results achieved by a number of managerial initiatives in the months and years preceding the launch of the Metro.

These various initiatives attempted to deal with the maintenance problem on a great many different fronts. However,they can be usefully categorized in terms of three major management strategies - each of which reveals a different aspect of the relationship between skill,

power and technology.

Strategy I

"You can persuade people to do anything."

- Personnel Manager, Metro Project

As the 'Check list' document indicates, by 1978 project management had developed a well-defined sense of the changes in maintenance orgainzation and skills that were appropriate or desirable for the new BIW facilities. The strategy which they adopted for securing such change was closely linked to the prevailing approach of negotiating change via the mechanisms of participation and collective bargaining. However, although management in this period were proceeding on the broad front of 'Management of Change', the organizational identity and political position of the Longbridge tradesmen means that management's efforts in this area can usefully be treated as separate from the broader sweep of negotiations.

In fact, in the previous period the trades groups at the plant had become increasingly distanced from the system of worker representation afforded by the Unit and Works Committee structure. Like many other craft groupings within BL, the Longbridge tradesmens' frustrations over pay bargaining and differentials - latterly exacerbated by the imposition of centralized bargaining - had found some expression in the Unofficial Skilled Trades committee led by Roy Fraser from Cowley. Paradoxically, however, their isolation from the mainstream of trade

unionism at Longbridge actually seems to have assisted the tradesmen in maintaining a cohesion and clarity of purpose which the production workers' representatives often seemed to lack.Nor were they committed as deeply and compromisingly to the mechanisms of participation as the leadership of the Works Committee had become. Thus,although the trades groups had been represented on the AD088 sub-committee team that visited the Fiat Mirafiori works,the trades had given no general or principled commitment to the kinds of proposals which emanated from that visit.Moreover,during the period of the 'Management of Change' strategy,the trades' powerful if isolated bargaining position was further buttressed by an acute and increasing shortage of skilled workers at the plant.By October 1979,in fact,it was estimated that Longbridge was around 150 tradesmen short of its requirements,and with the impending commissioning of the New West which demanded many more skilled workers, the situation from management's point of view had become extremely grave (20).

One result of the scarcity of skilled tradesmen was that,as the Metro's launch date approached,management's strategy became increasingly vulnerable to the trade groups' bargaining power.This was especially the case during 1979 when the trades' increasing apprehension about management's proposals led them to come together to form an unofficial,but united front in negotiations with management.The considerable collective

power which the tradesmen wielded was deployed first against the training programmes in new electronic skills,which management had instituted preparatory to the commissioning of the New West factory.Both the training programmes and later the commissioning work itself were 'blacked' by the unofficial grouping of trades as a way of putting pressure on management to discard their ideas about new maintenance practices (21).

Given that management were confronted with the imperative need to develop a suitably trained and flexible maintenance function for the new facilities,this combination of a shortage of skilled workers plus the 'blacking' of training programmes effectively meant that they were placed in a practically untenable position.Their response to this position was made at the Studdley negotiations in the summer of 1979,where the 'Management of Change' proposals were crowned by the following seemingly bland statement : "The employees within this function (i.e. maintenance) accept,as a source of recruitment,trained personnel from such areas as Government Skills Training Centres etc." (22)

Despite its innocuous wording,this proposal had explosive implications : by seeking to circumvent the trades' apprenticeship system and their monopoly control of maintenance skills,it embodied a direct attack on the very roots of trade organization at Longbridge.Of itself management's adoption of such a strategy as their only hope of achieving an efficient maintenance organization actually reflects the real bankruptcy of their

strategy of negotiation.For,only the most outright and unequivocal opposition could be expected from the trades.Indeed,not only did this proposal represent confirmation of all their earlier suspicions,but it was exactly the kind of attack on craft organization which they had long experience of resisting.As Liepmann noted almost two decades before in 1960 ;

> "Skill acquired by apprenticeship has never by itself sufficed to reserve the various trades to the craftsmen apprenticed in them, and modern technical development has sharply accentuated this insufficiency.With increasing mechanization,craft unions have found the question of how to control the entry of outsiders a difficult one...For the measures taken to defend craftsmens' jobs against unapprenticed workers no term has yet been coined ; they may be described as anti-dilutionism or vertical demarcations." (23)

Clearly,of all management's plans for changes in the maintenance function,the proposal to employ 'dilutees' from Government Skill Centres represented the most overt assault on the autonomy of the tradesmen within Longbridge.Certainly,its inclusion in the 'Management of Change' document contributed greatly to the trades groups' outright rejection of the management proposals. In a more general sense,however,this particular aspect of management's intentions,and the trades' hostility towards it,throws some light upon the importance of political considerations in the whole process of defining new skills and practices.

It appears that the essential weakness of Strategy I

lay not in the technical process of developing new skills and work organization,nor in the problems of legislating for the intrinsic uncertainty of the maintenance function.Rather Strategy I foundered because it proved unable to resolve the clash between managerial objectives and the political autonomy of the tradesmen. In effect,against the efficiency sought by management, the trades counterpoised a 'right to work' - something to be achieved not at the discretion of the individual employer but by the tradesmens' monopolistic possession of certain skills.It was in defence of such a position that the trades resisted first the management proposals for change in maintenance practices,and then,even more vehemently,the proposal to undermine the trades' monopoly of skill by the employment of 'dilutees'.

In this perspective,the failure of Strategy I was that,despite its technical grounding,its objectives and methods were ultimately incompatible with the balance of power which prevailed in Longbridge at that time - hence the 'blacking' of training programmes,the refusal of cooperation,and eventually the collapse of the Studdley initiative.

After the breakdown of the Studdley negotiations, although the technical implications of the new BIW facilities remained as urgent as before,management were forced into a thorough and painful re-assesment of their bargaining position.With no possibility at that time of

imposing the desired changes,Strategy I was definitively discarded in favour of alternatives that,while pursuing much the same objectives,employed very different methods.

Strategy II

"You have to keep whittling away." (24)

- Maintenance Manager,Longbridge.

In the aftermath of Studdley,BL management remained as anxious as ever to achieve the practical,if not the formal,subordination of the maintenance trades' practices and organization to its efficiency targets.But in their subsequent initiatives they abandoned the idea of negotiating a 'package' of radical change,in favour of a more unobtrusive approach.By focussing on the manipulation rather than the transformation of the maintenance work organization,they sought to avoid any head-on confrontation over job rights.This approach,which still offered the possibility of achieving important managerial objectives,had four major elements - each one aiming to bring some aspect of maintenance organization more firmly under management control.

a) Allocation Policy

The first element of Strategy II was developed towards the end of 1979,when management began investigating various 'fall-back' positions to the important but rejected goal of two-trade maintenance.Their chosen route,

which we have termed the 'Allocation Policy',was in many ways typical of the general thrust of the new strategy.Rather than demanding the wholesale revision of trade organization at Longbridge,it sought to secure the greater part of the two-trade objective via the mediation of technological factors.

It involved,firstly,the siting of a number of maintenance teams in on-line positions in the New West, alongside the particular machines for which they were to be responsible.Further,within these on-line teams, only two trades were to be represented : not all-round Mechanical or Electrical trades,however,but rather tradesmen from a mechanically-based trade - Jig and Tool fitters,say,or Pipefitters - together with Electricians.To cite just one example of many,under the Allocation Policy the Kuka Underframe machines were assigned to an on-line team made up of Machine Tool fitters and Electricians.

The cleverness of the Allocation Policy was that it quite effectively established two-trade,on-line maintenance in the New West,without actually challenging or transgressing trade demarcations.Within each on-line group the individual tradesmen could continue to regard themselves as Millwights or Pipefitters or Machine Tool fitters or whatever.But,while in principle the multiplicity of trade organization would continue to exist,in the process of production maintenance work organization would conform much more closely to the two-trade ideal.

For,it was management's firm belief that in practice the on-line tradesmen,no matter what their particular trade,would disregard the specialized demarcation lines, and respond flexibly to technical problems as they arose. As one manager explained,the main assumption behind the Allocation Policy was that ; "In practice people muck in when it comes to solving problems - demarcations are not so much of an issue." (25).

Clearly,although the Allocation Policy itself was based on no formal or technical set of criteria - merely the subjective judgement of a small group of managers - it served to bring the social organization of the trades much closer to the dynamic influence of the production process.It also represented management's best chance of achieving work arrangements akin to the Fiat model without provoking the united opposition of the trades. As a plant Industrial Relations manager commented ; "We have 90% of what we want,why risk major I.R. complications simply to achieve the remaining 10%." (26) Moreover,although the maintenance workers stationed in the central off-line pens were to retain the conventional trade organization,even this could be justified on grounds of efficiency - one of the project team of management claimed that ; "The demarcations in the off-line pens still exist because we want them to - specializations are necessary." (27)

In the development of new skills and practices for the Metro facilities,management's ability to install a

close equivalent to two-trade maintenance was undoubtedly a decisive step.In one sense,management's move to bring the tradesmens' operations much more under the sway of the technical rhythms of production indicates the possibilities of a form of 'indirect control' over the maintenance work-force.More generally,however,it demonstrates the way in which technical uncertainty may be distributed not by the abstract force of technological or organizational needs,but by a conscious managerial strategy acting through a given technology.

This is not to say,however,that the Allocation Policy was the complete panacea to management's problems. In fact,from late 1979 it was overshadowed to an extent by the managerial efforts to remedy the critical deficiencies in the area of training and recruitment.By early 1980 some kind of accomodation had finally been developed for these problems,involving a combination of different measures.Firstly,there was a general re-adjustment of maintenance manning levels in various sections throughout the plant to allow the re-deployment of a number of maintenance workers to the New West factory.This was supplemented by a country-wide recruitment campaign, which focussed on regions with a high level of unemployment amongst skilled workers - Glasgow,Merseyside,the North East,and so on.This campaign sought to recruit 500 skilled workers by the end of 1980,but in the end its results proved fairly disappointing,Finally,however, as a way of resolving some of the short-term maintenance

and training problems, management negotiated contracts with certain of the New West's plant and equipment suppliers - under which arrangements, 'consultants' would be provided to assist in the maintenance of the new facilities for periods of between six months and a year. Not only would these technical experts provide vital help in the difficult processes of commissioning and 'de-bugging', but they would also help to make good any inadequacies in the training of BL's own tradesmen.

b) Trade overlap

A second prong of management's strategy in this period was the general objective of securing a degree of 'trade overlap' in the practices of the maintenance trades. This involved a re-alignment in work practices such that the existing 'demarked' fragmentation of tasks might be succeeded by a more coherent definition of each trade's responsibilities. The trade overlap proposals effectively sought the elimination of many of the detailed differentiations between trades. For example, a task such as "removing and re-fitting of items of equipment - covers, guards, and so on - to enable electrical work to be started/completed" (28) was currently deemed to be fitters' work only. But under the overlap proposals, such tasks were in future to be carried out by any trade when necessary. The same precept applied to a task like "simple adjustments and/or replacement of limit switches, and the removal of equipment that has a plug and socket facility" (29) - such

work in future was to be the preserve of any trade and not only the Electricians.

In eliminating the more Byzantine strictures of "who does what", management, by and large, sought to avoid any erosion of the 'core skills' of the trades groups. The main aim of this approach was not to challenge the trades' demarcations directly, but rather at or near their margins. Even so, the re-alignment of tasks that was involved in trade overlap represented a useful degree of rationalization, ending some of the more inefficient aspects of the Longbridge trade organization and helping to reduce maintenance manning levels. Moreover, by this seemingly slight re-adjustment of demarcations, management were able to go some way towards the Fiat model of a task rather than trade-oriented maintenance function. Nor did the re-distribution of tasks involved affect any particular trade too badly. For example, under the trade overlap arrangements the Maintenance Fitters were to take on the responsibility for all maintenance work on the New West's conveyors and BIW storage systems - which entailed taking some work from the Pipefitters. On the other hand, the Pipefitters themselves were given complete resposnibility for the Heat Treatment plants within the BIW process - and this involved a transfer of certain tasks away from the Maintenance Fitters. (30). Thus, in some senses, a more rational maintenance structure was achieved - but only by taking full cognizance of the political implications of the new technical distribution

of tasks.

c) A new category of labour

One of the important points made by the BL studies of Fiat was that Fiat management had been able to set aside the most routine and menial of the maintenance function's responsibilities to be performed by a less skilled grade of labour. According to the AD088 sub-committee's report, the production engineers at Fiat claimed that around 90% of front-line maintenance work involved simply the repair and replacement of the spot-welding electrodes on their mechanized production lines (31).

At Longbridge such tasks as 'electrode dressing', 'weld setting' and 'tip changing' had all traditionally been the preserve of the skilled trades - and the Machine Tool fitters in particular. But with the installation of the highly automated facilities in the New West, including a number of mechanized spot-welding processes, the Machine Tool fitters' control over this routine kind of work was to be challenged. Management viewed the change in technology as both the occasion and the justification for the creation of a new grade of labour to carry out the routine maintenance of spot-welding electrodes. It was not only the BIW technologies themselves which prompted managerial action in this area, however. For, behind the proposal to develop the new grade of 'weld setter' lay more clandestine motives. In particular management were concerned to ensure that this

re-organization of maintenance work should serve to reduce the strategic power of the tradesmen within the new factory. In the words of one manager, the general aim was that "the maintenance function should diminish" (32). Another expressed his concern that management should prevent the maintenance function in the New West from becoming "a self-perpetuating oligarchy" (33).

With the creation of the 'weld setter' grade offering the opportunity to take a good deal of work away from the maintenance 'oligarchy', in the summer of 1980 management entered into negotiations with the Machine Tool fitters. In these negotiations management sought to justify their move by drawing on suitable precedents within BL : at Cowley the repair of welding electrodes was already the responsibility of a special grade of 'Gun Fitters', and at Longbridge itself, they claimed, an analogous situation existed in the East Works where a group of 'production setters' carried out the routine maintenance of drill-heads on the engine production lines.

Against these arguments, as the official record of the negotiations describes, the Machine Tool fitters grounded their case in the level of skill required in such work. They claimed that tip-dressing and weld-setting made up around 50% of their work, and further that such tasks were more skilful than management would allow : "The duties include changing tools and setting air gaps which can be complicated." (34). But, in reply, management

rejected the skills argument out of hand,basing their case on the following blunt demand for technical and economic efficiency ; "As Machine Tool fitters you will not be able to operate in the New West as you did in the old.Your responsibilities will be enhanced...We cannot afford inefficiencies in the New West works as Metro will be our life-blood." (35)

It seems that it was the latter argument,backed by the prevailing balance of power within the plant, which induced the Machine Tool fitters to make major concessions on this issue.By August 1980 management had been able to secure the greater part of their original objectives (36),and crowned their efforts with the Machine Tool fitters' acquiescence in the creation of the 'weld setter' grade.The Maintenance Manager took some enjoyment from the final success of management's strategy,explaining that ; "We have eroded and eroded until we were in a position to secure an agreement." (37) Thus,although the exact details of the new grade had not been finalized by the time of the Metro launch,there seems little doubt that it represented one of the major successes of an approach that was so clearly based upon the 'erosion' of the trades groups' position.

The process of erosion was not confined simply to the more routine or menial elements of the maintenance tradesmens' work,however.The introduction of new technology

on such a large scale at Longbridge provided further opportunity for the development of a basically hierarchical division of labour within the maintenance function. In particular,it allowed management to install a controlling managerial presence at the highest level of this new hierarchy - in the form of the new 'Control Engineering' department.

d) Control Engineering

As early as 1978,BL engineers began to draw up plans for this new managerial function at Longbridge. From the very beginning its creation was aimed at the expropriation of certain of the specialized electronic skills associated with the advanced technologies of the New West factory.While such skills were currently beyond the ambit of the Longbridge trades groups,the creation of the new department was bound to have political ramifications - if for no other reason than that, Maintenance supervision excepted,it represented the first managerial intervention in the day to day activities of the maintenance function.

Initially,management sought to emphasize the higher level of expertise and the more abstract skills subsumed by the Control Engineering department.Given the basic assumption that there was "a ceiling to the capability of the maintenance trades groups" (38),the role of the Control Engineers was justified on the grounds that,as one manager put it,they needed to be "more deep-thinking" (39).The creation of the new group

was thus explicitly linked to the technical needs of the new sophisticated BIW technologies in the New West.

However,for all the claims as to the higher technical skills of the Control Engineers,it is an interesting point to note that the first batch of recruits into the new function all came from the existing maintenance group - being either Maintenance supervisors or experienced tradesmen.

But despite the seeming contradictions of management policy,the original proposals for the new department, which were drawn up in May 1979,indicate that Control Engineering was to provide an important range of services within the BIW plant.Its role was directly linked to the new technologies of the BIW process,such that according to the relative sophistication of each technological system the Control Engineers were to provide either 'Maintenance Engineering' services or 'Specialized Engineering Support' (40).

The former involved a more comprehensive set of reponsibilities,and was to apply to the most advanced systems,namely the Computer controls of the APS,the Asea and Trallfa robots,and the ISI communications system (41).For these technologies - constituting the most technically complex and critical points in the production process - the Control Engineers' responsibilties were wide-ranging,and encompassed such tasks as fault diagnosis, management of the stocks of spares,and the documentation

and reporting of servicing procedures.Indeed,even the so-called 'support functions' which applied to the PLCs,CWCs and the Unimate robots were considerable, including 'fault diagnosis support' and the control of workshop repairs for the Unimates.

Overall the Control Engineering department was clearly intended to have a substantial impact upon the operations of the maintenance function.Moreover,as the original outline indicates,not only were the Control Engineers to monopolize a number of the more important maintenance tasks within the the New West,but their duties also extended to a significant supervisory role. Far from simply acting as technical experts,the Control Engineers were also expected,for instance,to "coordinate tradesmen as appropriate on plant when a problem is beyond the normal scope of a tradesman and his supervisor" (42).Similarly,the Shift Engineer in the new department was expected to "coordinate activities of maintenance tradesmen on specific jobs" (43).Further, the interview comments of management serve to amplify the intentions behind this 'coordination'.One of the BIW engineers spoke of the Control Engineers' role as "to bridge the gap...eliminating the over-use or mis-use of tradesmen" (44).Another commented on the need for the Control Engineers to be "trained into a certain way of thinking,so that they can guide the tradesmen" (45). Perhaps the most revealing comment of all,however,is simply a brief,hand-written note,scribbled in the margin

of the formal outline of the Control Engineering function.This note explains that the Control Engineers are to control the stock of maintenance spares because this task is "seen as function of maintaining authority"(46).

From all the evidence then,it seems fairly safe to assume that the development of Control Engineering, though prompted by the advent of the BIW technology,was also closely bound up with certain more political overtones.Certainly,the need for new and more abstract electronic skills served as a useful rationale for excluding the maintenance tradesmen from any significant degree of control over some of the most important new technologies.By and large,the creation of the new function seems to have proved a remarkably successful means of ensuring the managerial appropriation of such critical areas of skill.In this way,the new hierarchical maintenance structure was enlisted much more in the service of productive efficiency than in aid of the job rights and controls of the trades groups.

In this context,a general comment from Clegg and Dunkerley seems especially appropriate :

> "De-skilling does not mean that the worker loses total control.What is involved is that the control function which previously skilled workers exercised passes from them in conditions of job re-design to 'higher' levels in the job hierarchy.Control becomes less and less the task of those who fill the places designed as de-skilled work,and becomes more and more a specialist skill-in-itself at a higher level in the organization." (47)

The implications of Control Engineering for the plant as a whole were probably greater in the long

than the short-run. Initially, at least, the new department was confined to the BIW process, and even there its impact upon the strategic importance of the trades groups was counter-balanced by the increased maintenance requirements of the new automated technologies. Over the long-term, however, the establishment of the Control Engineering function indicates that technological change held considerable potential as a means by which management might circumvent a politically troublesome group.

Although very diverse in their application, the various elements of what has been termed Strategy II all contained one basic common denominator ; namely, an attempt to secure managerial objectives by manipulation of the emerging maintenance work organization in the New West factory. In their concern for tasks and skills that were peripheral or novel to the existing trade organization, management not only demonstrated their appreciation of the new technical character of the BIW process, but also their awareness of political possibilities inherent in the situation. Indeed their various initiatives focussed upon the technical and political margins of the maintenance function to great effect - the routine tasks, the overlapping tasks, the 'higher' skills, and so on. As a result, management were able to achieve many major elements of what they perceived as an efficient maintenance organization without any direct, principled confontation with the tradesmen. Although the new maintenance structure

effectively subordinated much of the trades' traditional autonomy and many of their job rights to the overriding goal of efficiency, the managerial tactic of linking the changes in organization to technological factors seems to have undermined the trades groups' resistance. Thus, while the situation was far from being entirely resolved by the time of the Metro's launch, important bridgeheads had already been established.

The development of the Control Engineering function, for example, had served to install a substantially greater degree of managerial intervention in the operations of the maintenance trades. Moreover, because management had grounded the Control Engineers' role in certain novel and more abstract skills, the trades groups had neither the force of precedent, nor of existing job controls, to support a stand against this intrusion. Although the tradesmen did protest against certain of the more superficial aspects of the new function - against managerial staff taking tools onto the shop-floor for instance - such protests could have little more than an irritant effect on management's freedom of action.

But while the technical niceties of Strategy II seem to have contributed greatly to the achievement of an efficient maintenance function in the New West, it should not be assumed that this kind of technological camouflage sufficed by itself to secure management's purposes. Rather, the tradesmens' acquiescence in many of management's aims needs to be related to the general

shift in management-worker relations within BL as a whole.More specifically,it should be linked to the way in which this 'weather change' in industrial relations translated into the plant-level balance of power between management and tradesmen.

Strategy III

"Unless you're desperate you don't do things in this way." - Maintenance Manager,Longbridge (48).

Quite apart from the many changes in maintenance organization associated with the new Metro facilities, this period at Longbridge also saw a more general managerial assault on trade practices.As was noted earlier, the imposition of the Draft Agreement within BL encouraged plant managements to embark upon a large-scale revision of work practices on the shop-floor,and this applied with equal force to the maintenance groups in Longbridge.In the aftermath of the Draft Agreement,the changes sought by management,while reflecting the climate of financial crisis and managerial 'desperation' within the firm,entailed a general attack upon trade organization and job controls at the plant.

Management's first step in applying the Draft Agreement - one indicating clearly the scale and intensity of their attack - was to declare the abolition of all existing custom and practice at Longbridge,including a total of at least 73 different management-trades agreements. The significance of this move was that it sought to sweep

away the entire, complex pattern of job rights and practices which had evolved over the previous twenty years or more (something of the tenor of these agreements and practices is indicated in Appendix Four).

While Strategy II had furthered the goal of efficiency via the development of a new division of labour in the maintenance function, the application of the Draft Agreement was largely a function of the broader political processes within BL. This Strategy III, as it will be termed, was directly aimed at the termination of what had previously been the joint regulation of the maintenance work-force. Some of the detailed implications of the imposition of a managerially-defined set of work practices are illustrated in Table One. This presents the changes outlined in management's 'Implications' document, together with the claimed effect of current practices.

In attempting to impose the new arrangements, however, management could not act as forcefully against the trades as they had done against the production work-force. Indeed, the process of introducing the changes was a good deal more uneven and confused than the clear-cut, formal status of the Draft Agreement would suggest. Nevertheless, by July 1980 the Industrial Relations manager for the maintenance trades was able to report that a number of the planned changes had been 'introduced and accepted', and these are detailed in Table Two.

The overall effect of such changes was to further

TABLE ONE

Action by management	Constraint/Effect of Current Practice
Toolroom trades to respond to Production supervision.	Overmanning of maintenance.
Toolroom trades to respond to two-way radios and other aids to communication.	Delays in repairs, loss of productiion.
Maintenance to cover emergency breakdowns during lunch-times or tea-breaks.	Extends breakdowns.
Night-shift maintenance to carry out installation and repair work as well as 'front-line' maintenance.	Inefficient use of labour.
Maintenance to be mobile between one section and another.	Loss of production and overmanning.
Introduction of planned maint-enance shift.	Increases downtime and therefore prod-uction losses.
Introduction of 05-21 and NTA (Quality and Calibration standards)	Lack of responsi-bility for quality of own work.
Paired working arrangement for electricians (safety cover) to be ended. Saftey cover only in certain areas, and may be personnel other than electrician.	Overmanning, ineff-icient use of skilled labour.
Maintenance to complete records of work done.	Reduces efficient control.
Industrial engineering of maintenance work where required.	Inefficiencies in use and establish-ment of manning levels.

'Implications of the introduction in changed working practices': Maintenance clauses (49)

TABLE TWO

'Introduced and Accepted'

1. A formal system of planned lubrication and calibration, and recording of same.

2. A job reporting system for the tradesmen - previously refused to log their own work.

3. A change in work-hours for night-shift maintenance in Old West - now coincide with hours of production shift.

4. Emphasis on full mobility across the plant - previously management had the principle but unable to exercise it.

5. Tradesmen to work below their grade when necessary.

6. 'A degree of flexibility and self-motivation' - along with introduction of log-sheets, maintenance now responding to production supervision.

7. Maintenance now responding to telephones or other communication aids.

8. Adoption of a 'progressive attitude' in replacing spares.

9. No limitations on overtime - previously trades had allowed overtime only with 24 hours notice or on a 'one in, all in' basis.

10. 'Light up' shift (generally Sunday evenings) may be required to perform outstanding maintenance work or breakdown repairs.

Changes in maintenance practices : introduced by July 1980 (50)

undermine the trades' autonomy.By making the tradesmen responsive to production supervision and to communication aids such as two-way radios,management enhanced their degree of operational control over the maintenance function.Moreover,as if to give this new element in management-trade relations some material expression,the design of the New West factory incorporated a number of features aimed at facilitating managerial supervision. Some pens were provided with wire-grills rather than windows in order to ensure an uninterrupted view inside, tables and chairs were prohibited and lockers were set at the far end of each pen so that clothes and personal belongings could only be retrieved at the end of a shift.

There seems little doubt that in the period after April 1980,Strategy III was an important instrument in securing a number of managerial objectives,and in the installation of a much more formalized system of management control over the maintenance function.Yet, even though the tradesmen were in this sense just as much the victims of the general political trends in BL as the production work-force,the management victory in this period was far from complete.In fact,by October 1980 some important issues were still unresolved,and in a number of areas management's initiatives had been strongly rebuffed.This was especially the case with management's long-standing aim of introducing a three-shift planned maintenance system in the New West.Management's failure

to implement planned maintenance by the time of the Metro's launch - despite the technical rationale behind it - was largely attributable to the trades' groups firm rejection of the shift-working that it implied. On this score,even the combined efforts of Strategies I,II and III seemed unlikely to secure an aim which had been identified as of critical importance as early as 1978.This in itself indicates management's inability to entirely emasculate the trades organization at Longbridge.

However,perhaps the greatest problems in securing major changes in work practice by the coercive methods of Strategy III lay not in particular victories or defeats,but in the intrinsically narrow scope of such a strategy.While Strategy III laid down a new formalized set of rules for regulating the deployment of the maintenance work-force,it was less effective with some of the most important aspects of maintenance work. When the Strategy III approach was applied to the informal substance of the individual tradesman's work it was reduced to the level of vague and imprecise exhortations.For example,under the terms of the new arrangements,tradesmen were formally required to show "a degree of flexibility and self-motivation",and to "adopt a progressive attitude" in performing their tasks (51).In those many aspects of the tradesmens' work which were not amenable to formal regulation,management's efforts to secure efficiency were thus intrinsically

limited. In this sense, the maintenance workers' control of uncertainty made it unlikely that the kind of coercive approach represented by Strategy III could ever be completely successful - being more likely to encourage recalcitrance than cooperation amongst the maintenance tradesmen.

Given that neither technological design nor managerial strategy were able to eliminate such uncertainty within the production process, the maintenance function was always likely to have some element of strategic power at its disposal. But what really mattered, against this backcloth of radical technological change and managerial attacks on their organization, was how the trades groups made use of their power within the political process. In particular, if the trades were to safeguard their future interests they needed to secure the renewal of their craft skills, and re-establish their position in the new production facilities. It is the trades' intervention with management to secure such objectives that provides probably the best example of their resistance to management control. In a more general sense it also furnishes an illustration of the relationship between skill and power at the Longbridge plant.

The renewal of skill

The tradesmens' ability to achieve the renewal of their skills had a great deal to do with their ability to extend existing job rights and controls to encompass the

new technologies of the BIW plant.The process by which the trades' technical and political position was secured is best illustrated by reference to two specific examples of the new technology itself - namely,the Unimate robots and VDUs.

a) Unimate robots

The critical role of robotics in the New West was not only a matter of concern to management,but also attracted the attention of the tradesmen at an early stage of the Metro project.Indeed,so great was the trades' interest in establishing suitable precedents for this new technology that when a single Unimate was installed in the old West Works early in 1978 (to provide practical operating experience) it immediately triggered off full-blown negotiations on the issue of maintenance practices.

With their eyes firmly set on the forthcoming introduction of 28 Unimates,the central issue raised by the trades in these negotiations was over the demarcation line between the Machine Tool fitters and the Electricians.Although for the most part the trades had little difficulty in identifying maintenance responsibilities for the robots - the electricians dealing with the electronic controls,the fitters servicing the robot's arm and tools - it quickly transpired that the critical question was over the programming of the Unimates.The official record of the negotiations reveals that with

no already existing precedents or job controls in this area, the attempt to define the demarcation within the programming task led to inter-union conflict.

At first, management conceded to the Electricians the responsibility for "making the final production programme". But this quickly led to a counter-claim from the Machine Tool fitters in September 1978 ; "We claim the sole rights to put on the mechanical programme and for that programme to be included in the final programme on the Unimate." (52) With both groups concerned to secure their 'right' to programme the robots, management were able to resolve the situation only by involving both groups in the programming process. They laid down, firstly, that "programming and re-programming of any of the mechanical movement" was to be the responsibility of the Fitters. However, the Electricians retained the right "to complete the programme (heat, squeeze and time of weld-settings) and to check the programme time". The Electricians were also given control of the master programme tape, because, claimed management, "we must make one man or one trade responsible for the master tape. If we do not we would lose control of the machine." (53)

Overall, although the Unimates provoked some dispute between the two trades - the Fitters at one point even fearing that the Electricians might 'wipe clean' their mechanical programmes - this conflict had the effect of ensuring a precise delineation of the trades' job rights

over this new technology.

b) VDUs (Visual Display Units)

The highly automated systems of the New West demanded the extensive use of VDUs in a number of areas, but one of their most important applications was as part of the Facility Monitoring system.Here VDUs were employed for the presentation of circuit control information and diagnostic analyses on the major Kuka and Sciaky welding-lines.In combination with other parts of the machine monitoring system,VDUs thus played an important role in the maintenance of the new facilities.

Once again,some time before this new technology was put into operation for maintenance purposes,there was an attempt by the Longbridge tradesmen to establish and extend job rights over its use.In this case the claims came from Electricians,who put forward a demand for exclusive use of the VDUs as a maintenance tool. They based their claim on precedents,claiming that since they enjoyed an exclusive prerogative to operate the few VDUs in the rest of Longbridge,this right ought to be extended to the many more VDUs installed in the New West factory.

However,although the Electricians accepted that the mechanical trades had the right to make use of information presented by the VDUs,their claim to sole and exclusive rights to operate the machines was greeted with little enthusiasm by management.In management's

view the development of a flexible and responsive maintenance function in the New West demanded that all trades should be able to make use of such a critical technology as VDUs.The result was that by January 1980,with electricians defending their demarcation and management their efficiency targets, the battle lines were sharply drawn,and the VDU issue had assumed the character of the main stumbling-block to the electrical trade's involvement in the New West. Notwithstanding considerable management pressure,however, the electricians were determined to establish their position in the new facilities - not least because of the possible precedent that it might set for the use of VDUs in the rest of British industry.This kind of resolution led to the intervention of senior national officials of the Electricians' union to reinforce their case.

Faced by this solidarity,and the Electricians' apparent readiness to strike over the issue,management were eventually forced to concede a compromise 'understanding' in February 1980 - as detailed in Table Three.

The provisions of this 'understanding',though taking account of "extremely urgent and critical nature of the Metro programme" and the "efficiency of the Metro system",essentially involved a provisional acceptance of the Electricians' exclusive rights to operate the VDUs - excepting only the Maintenance Supervisors and Control Engineers.Admittedly,management did succeed in

inserting the important proviso that the arrangements would be reviewed after one year - and in the light of the need for 'efficiency',which could hardly help but serve management's interests.Yet,if this issue - like many other conflicts discussed here - could only be resolved over a period of years,the first stage of the struggle at least had gone in favour of the Electricians and their job rights.

Conclusion

Without attempting to summarize the detail of this long and complex chapter,a few major points have emerged which can usefully be highlighted here.Firstly, it is worth noting that,for all the design features incorporated in the new BIW plant,management found it very difficult to achieve any kind of technical control over the operations of the maintenance workers.At best, their efforts managed to achieve a degree of 'indirect control' by the on-line location of the maintenance teams.On the other hand,the automated character of the new facilities actually served to reinforce the strategic importance of the maintenance function by creating new demands and new areas of skill.As Elger notes in another context ; "The continually revised character of modern mechanized production persistently renders 'incomplete' the subordination of labour to capital...it creates new skills,new competencies and other opportunities for bargaining leverage." (55)

It would be a mistake, however, to attribute the degree of autonomy retained by the trades entirely to their possession of technical skills. Management's ability to manipulate the development of a new work organization suggests that even the intrinsic freedom of action enjoyed by maintenance workers was not immune to the possibility of management control. Indeed, to recall an earlier discussion, although the maintenance trades' 'subordination within production' was not practicable, management made strenuous attempts to secure their 'subordination to production'. The many managerial initiatives seeking to achieve 'efficient' work practices and organization demonstrate the importance that was attached to this form of subordination.

Equally, the trades' efforts to preserve their trade organization and skills depended in large part on issues that were extraneous to the production process itself - most notably, their rejection of 'dilutionism'. Moreover, even in the renewal of their skills, it was the collective power of the trades as much as the technical aspects of skill itself which determined their future role. In fact, the whole apparatus of job rights and demarcations which the Longbridge trades developed and to an extent were able to transfer to the new BIW facilities, serves to underline the political implications of skill. Beyond skill for its own sake, there seems to be a formulation of skill which is more important for its political than its technical

aspects ; a form of skill or set of skills which serves as the basis for collective power.

At Longbridge it seems that as long as the trades were able to link their intrinsic skills to a cohesive and resolute collective organization, management's efforts to render the maintenance workers completely flexible and submissive were unlikely to be totally successful. Indeed, management's attempts to re-define the maintenance function by the creation of new grades such as the 'weld setter' only seemed likely to pave the way for future demarcations and future rigidities.

Even the coercive efforts of Strategy III - reflecting the deeper change in the balance of power of BL as a whole - could only achieve the short-term acquiescence of the trades. No such approach could ever hope to achieve the trades' lasting adhesion to managerial values, nor their willing cooperation in managerial objectives.

CONCLUSION

It would be difficult to adequately summarize the contents of this lengthy work in just these final few pages.Any attempt to to deal with the affairs of British Leyland,an organization of great scale and importance,must necessarily become involved,if hopefully not entrapped,in the detail of the firm's recurrent crises.Moreover,the very process of defining and undertaking a fairly novel approach to the question of technological change entails a wider scope for study than might be the case in other fields.Indeed,as this work has sought to analyse the linkages between many different issues - ranging in the empirical work alone from BL's finances to the issues of industrial relations and to the technical niceties of the automated technology itself - it is hardly possible to give adequate expression to the analytic thrust or coherence of the work in a precis form.However,given these reservations,it does seem worthwhile at this point to re-trace our steps a little,and attempt to draw out some of the linkages between the various chapters of the thesis.

The thesis began on a theoretical note with the first few chapters devoted to a discussion of the

respective roles played by social, economic and technical factors in the process of technological change. Against the background of what are often taken to be all-embracing technical or economic considerations, these chapters served to isolate and define the operation of a form of social control over technological change in industry. Further, an examination of the economic stimuli to technical change - economies of scale and so on - suggested that, while undoubtedly important as the calculative basis for investment decisions, they were best viewed as integrated within an essentially managerial process of control. Were this managerial process taking place under conditions of 'perfect competition' then it might justifiably have been disregarded as a factor of significance. However, when managerial decision-making on technology was located in the context of the oligopolistic motor industry, its importance seemed to be of a much greater order than simply a passive response to market pressures. Rather, management's control of technology was seen to be an integral part of the major producers' development and pursuit of corporate strategies.

The importance of this form of strategic control was analysed first at the level of the industry as a whole in Chapter Three. With reference to the examples set by assembly-line methods and industrial robotics, the car manufacturers' introduction of new technologies

was discussed in a historical context, and a brief outline given of the social and political as well as economic implications of such major changes in technology. In particular, the adoption of industrial robots within the industry was seen to be far more the result of the evolving corporate strategies of the major manufacturers - and especially their so-called 'World Car' policies - than the purely operational advantages offered by robotic technology.

Having identified the importance of strategic control at this level, the next step was to apply the analysis to BL itself. In Chapter Four this was done by relating the evolution of BL's corporate strategy, and linked with it the firm's organizational structure, to the overall pattern of production arrangements. By tracing the long historical development of BL's competitive and production strategies, the piecemeal growth of the corporation and its constituents was seen to have placed important constraints upon the kind of strategy and hence the kinds of technology available to management in the recent period. Moreover, the long-term decline in BL's competitive and financial position which was associated with these factors had the effect of imposing certain direct limitations upon the firm's ability to invest in new technologies.

Eventually, after years of under-investment and the increasing obsolescence of machines and equipment, government intervention embodied in the Ryder Report of

1975 provided the strategic impetus to the technological change and modernization at Longbridge.At this time, contained in Ryder's small car prescription,certain strategic objectives were laid down for production at the plant.In Chapter Six,the direct links between these objectives and the actual technologies installed in the new BIW plant were detailed.It was found that the overriding factors in the design of the new technologies were,firstly the economic criteria of output and productivity,and secondly what were termed the 'socio-technical' criteria aimed at relating the technological design to the social infrastructure of the Longbridge site.Purely technical factors seemed to play a relatively minor role in the design process.

However,while the design of the new BIW plant reflected in a fairly direct way the strategic assumptions and preferences of the Ryder Report,the overall significance of this investment and the contribution made by the technological change itself were greatly amended in the period between the plant's design and operation.As BL's financial and competitive crises came to a head,the objectives of the Ryder strategy were set aside in favour of a new policy of rationalization and 'de-manning'.Under Sir Michael Edwardes' direction,the Metro project was placed in a very different strategic context from the expansionist aims of Ryder, and BL management placed the greatest strategic emphasis

upon achieving a substantial increase in the levels of labour productivity within the firm.Higher levels of productivity were viewed as the key to at least compensating for the competitive advantages of scale and multi-nationalism enjoyed by the largest producers.

Yet,while BL management had come by the end of the 1970's to define production efficiency and productivity as the highest priorities to be secured from technological change,of itself new technology or even a new strategy could achieve nothing.In fact,management's success in attaining their strategic goals depended very largely upon their relations with the work-force. Indeed,by the end of the decade management-worker relations had come to determine not only the levels of efficiency attained by the firm but even its very survival.

To try and explain how this relationship between management and workers could achieve such a critical status and how it might affect the process of technological change itself,Chapter Two sought to provide a useful if brief theoretical framework.Further,this chapter served to underline the general importance in the control of technological change of the degree of authority exercised by management over its workers. It was noted that this was not simply a question of management securing a technical form of control over labour and production,or even of the use of technology to de-skill the workers and reduce their discretion. Although these latter aspects were certainly important in,for instance,the adoption of process technologies

such as industrial robotics or the assembly-line,it could only be a partial explanation of management's control of technology.Greater emphasis was placed upon management's need to secure its planned levels of efficiency from the new technological systems.This was seen to depend in large part upon the balance of power between management and workers within the firm - and in particular,the extent to which the trade unions were able to develop specific job controls in opposition to management's more general control of production.It was suggested that only when management had been able to deal with such constraints - by securing either the work-force's cooptation or compliance to managerial values of efficiency and profitability - could a major change in process technology secure the efficiencies for which it was designed.

Obviously,these general points had great relevance when applied to BL,for management's search for greater productivity from changes in technology brought them into direct conflict with the trade unions precisely over issues such as these.This conflict was fought out upon the political terrain of collective bargaining both at plant and company level.Moreover,although events at the Longbridge plant itself had the most direct bearing upon the technological changes there, management's control of the work-force in a political sense had to be secured first at the level of the company.

In dealing with BL's company-wide system of industrial relations, Chapter Five notes the difficulties which management encountered during the 1970's in trying to secure its efficiency goals. Even during the earlier period, management had found that the piecework payment system, which at least secured efficiency of a sort, served to act against their objectives over the longer term by undermining their shop-floor control. In addition, their problems were aggravated by the de-centralized and diffuse character of industrial relations within the BL empire. For these reasons, and despite the strategies contained in a new payment system and the machinery of worker participation, it was only towards the end of the 1970's that management began to articulate a strategy that might resolve its efficiency problems. In part, the new strategy developed by Sir Michael Edwardes involved the centralization and rationalization of the fragmented system of industrial relations. But a more important aspect of this new strategy was the way in which it exploited the 'streamlining' and redundancies attendant on BL's economic decline as a political weapon against the trade unions' power within the firm. The coercive discipline of job cuts which was applied during 1979 and 1980 finally culminated in the imposition of the 'Draft Agreement' in April 1980. This document, though subject to the 'interpretation' of plant managements, secured for

BL management a much more unilateral and untrammelled control of production than they had previously exercised. The productivity goal had thus finally been installed as the predominant feature of relations between management and workers, and the shop-floor status of management in the guise of, for instance, the Industrial Engineering function, was greatly boosted.

And yet, despite the seemingly conclusive victory over the unions in 1980, there were many indications that the success of management's coercive strategy was in many ways as precarious as the political and economic circumstances which that strategy sought to exploit(1). This was especially the case at Longbridge where events both before and after the imposition of the 'Draft Agreement' seemed to underline the incomplete and contingent character of management's new regime. In the period to the end of 1980, for example, the impending and actual technological change at the plant gave Longbridge a degree of both technical and political autonomy from the rest of BL, such that even major shifts in the balance of power at company level still left plant management with considerable problems in the implementation of their plans. As noted in Chapter Eight, although management played the principal role in the control of technological change, not every item was entirely under their sway and their control was never completely secure.

Overall, management's control of technology at the plant seemed to vary according to shifts in the balance

of power at both company and plant level.Given these factors it is hardly surprising that a recurring feature of the research interviews with all groups of management - from Production Managers to Electronic Engineers - was the importance which they attached to the actions or the 'attitudes' of the labour-force. While the Longbridge work-force appeared mainly as a source of disruption in many managers' eyes,no-one,not even the most technically-minded engineer,ignored or underestimated the importance of the workers as a critical component of technological change.

Moreover,over this period the role of the labour-force at Longbridge was the subject of intense managerial effort to ensure that the planned efficiencies of the new technology were achieved in practice just as much as in design.The form and content of management policies varied with the fluctuating course of indsutrial relations as a whole.At first,as was noted in Chapter Seven,management sought to achieve their ends via the machinery of participation : this succeeded in drawing the trade unions into a fairly close,cooperative relationship,which despite its intrinsic problems seemed to offer benefits to both sides.However,for all its advantages to plant management, the participation exercise of the AD088 sub-committee eventually foundered on the new hard-line policies adopted by corporate management - demonstrating in the

process that the problems inherent in participation were less damaging in the long run than the political and economic context in which participation took place.

The new managerial policy towards the unions, in seeking to re-define the whole texture of industrial relations throughout BL, had a profound effect upon events at Longbridge itself. The 'Management of Change' approach which sought the negotiated acceptance of work practice changes was simply swept away by the new centralizing, standardizing corporate style. Partly as a result of this corporate intervention, the ensuing conflict between management and unions found its most intense expression not at the point of production or in a clash over new technology per se, but in a political conflict between the controls and interests of the two sides. As management sought to exploit their political advantage by eliminating many of the unions' long-established job controls, certain groups such as the Sheet Metal workers engaged in a resolute defence of their practices and demarcations. The essential issue was one of control, control over both the process and outcomes of technological change. On the one hand, management backed by the 'Draft Agreement' sought to secure their overriding strategic goal of increasing the plant's efficiency. The technical changes at the plant furnished them with both the instrument and the occasion for such efforts. On the other hand, the trade unions, though placed in a difficult position and

sympathetic to the Metro project itself,were unwilling to accept the price of the managerial version of efficiency ; namely,the unconditional surrender of union job rights and controls.In effect,the unions were unwilling to give up their right to safeguard the interests of the work-force by exerting some kind of control over the conduct of production.Thus the resulting conflict with management,although closely intertwined with and sometimes shrouded by technical factors, was at its core a political affair.

This applied even to the maintenance work-groups who had more interest than most in the detailed implications of the changes in technology.The conflict here arose partly from the fact that managerial efforts to suppress skill level in the New West and reduce the maintenance trades' strategic importance could never be completely successful.Faced with the intrinsic difficulty of regulating the trades by purely technical means,management turned to more explicitly political strategies.For only by undermining the maintenance groups' collective trade organization could 'efficient' work practices be installed on the new production lines. However,the problems in dealing with this skilled and powerful group of workers were effectively underlined simply by the number of managerial initiatives aimed at this target.

Strategies I,II and III all served to emphasize

the point that de-skilling was as much a matter of the power balance at the workplace as the technologies adopted. Indeed, management's ability to exploit some of the most technically marginal aspects of production for their political purposes effectively demonstrated the overlapping of technical and social factors in the development of a work organization. Equally, the trades groups themselves by their concerted resistance to managerial objectives, and their ability to renew skills and job controls in the new plant, showed that the ability to retain some degree of control over technological change was far more than a matter of intrinsic skill, but depended also on political cohesion and resistance.

In the end, however, as later chapters indicated, management were able, by a combination of participation, persuasion and negotiation, to secure the greater part of their aims. Both the maintenance and the production workers were brought under close management control to a much greater degree than before. In the aftermath of the Draft Agreement, a new managerial regime and a new order of efficiency were installed at the plant, being the fruits of management's political campaign as much as, if not more than, the effects of a shift in technology (2). The effectiveness of this new regime can be gauged from BL management's subsequent claim to have increased labour productivity at Longbridge by over 100% in 1981,

the first full year of production (3).

Clearly,as such figures indicate,by the end of 1980 management at Longbridge had succeeded in placing a tight grip upon the process of technological change. After a long and intense struggle they had been able to supplement their undisputed control over the design of the new technology with an unequivocal and uncompromising imposition of their own standards of efficiency on the new automated lines.Yet,as Chapters Eight and Nine also illustrated,both the production workers and maintenance tradesmen at the plant could not be easily coerced into accepting the new order of things.Their continued if diminished resistance to management control demonstrated at least the possibility of retaining some collective restraints on management's command of production.

Thus,management's coercive tactics seemed to have achieved at best a temporary victory over the trade unions at the plant,and had in no sense secured the much sought after 'change in attitudes' on the part of the work-force.In effect,at the end of the case-study as at the beginning,the control of technological change at Longbridge remained a matter of unresolved and in some ways irresoluble dispute.

APPENDIX ONE

BL'S FINANCIAL POSITION

The investment programme detailed in the 1980 Corporate Plan - as detailed in Table One - represented a major commitment on BL's part. Although not on a par with the investment plans of the other major European producers, the financial commitment that it involved was well beyond the capability of BL itself to generate. Its effect was to further increase BL's dependence on government funding, such that by 1981 the governmental contribution, and hence BL's vulnerability to political forces, was raised to even higher levels. Over £1,000 million was allocated to the task of supporting BL for the period 1981 to 1983 alone.

However, while the firm's continued dependence on government aid served to underline its financial weakness in this period, the truly critical nature of BL's plight is best expressed in the 'cash flow analysis' carried out by Professor T. Lee (Department of Accounting and Business Methods, Edinburgh University). This kind of analysis presents BL's financial results on a pure cash basis, free of credit transactions and arbitrary allocations such as depreciation. The accounting conventions of the balance-sheet are set aside in favour of

TABLE ONE

	1980	1981	1982	1983	1984	1985	Total 1980-85
Metro	79	30	5	-	-	-	114
Metro facelifts	-	-	1	2	13	27	43
1980 Marina facelift	4	1	-	-	-	-	-
Princess F/L	8	13	3	-	-	-	24
LC9	32	41	27	5	-	-	105
AM2	-	-	11	61	33	33	138
AM2X	-	-	-	5	21	34	60
Sherpa F/L	1	2	4	1	-	-	8
AJ6 Engine	6	16	10	-	-	-	32
Jaguar development	-	5	20	33	17	9	84
TR7/8	-	7	12	4	1	1	25
SD1 development	-	2	10	21	31	25	89
Land Rover expansion	44	45	41	19	15	16	180
Other	91	94	104	103	157	172	721
TOTAL	270	289	333	303	306	317	1819

BL CORPORATE PLAN : CAPITAL EXPENDITURE (£million)

simply showing the amounts of cash flowing into and out of the organization - sales receipts set against operating expenses,and so on.As collated and detailed in Table Two, the cash flow analysis of BL's recent results helps to pinpoint the fundamental,long-term weaknesses of the firm.For example,subtracting 'operating payments' from 'sales receipts' reveals that in only two years out of the seven (1974,1978) did BL produce any kind of cash flow surplus from operations to finance capital spending and interest payments.In fact,over the seven years BL accumulated a deficit of £153 million simply on the balance of day-to-day cash expenditure against sales. The analysis also presents a rough translation of the total annual cash flow into 1980 prices,and this indicates that there is a remarkable consistency in BL's 'real' cash flow deficits.When compared to the cash flows of Ford,which are outlined in Table Three,BL's financial crises are seen to be paralleled by a robust state of financial health on the part of its American rival ; BL's problems are counterpointed by a steadily rising surplus in Ford's operating cash flow.

But the significance of this form of financial analysis is not only a matter of the insight that it gives into BL's current performance.It also sheds some light on the firm's future financial prospects : Figure One presents the recent record of BL's finances,along

with certain projections made by BL management as to the firm's future financial performance.The importance of the clear contrast between past trends and future ambitions is probably best left to the reader to decide.

Sources : T.Lee,Internal Seminar,Napier College, Edinburgh,2.2.80

: Financial Times,23.10.81,p.15

TABLE TWO

BL CASH FLOW RESULTS : 1974 - 1980

(£ million)

	1974	1975	1976	1977	1978	1979	1980	Total
Sales receipts	1,603	1,805	2,835	2,557	3,031	2,940	2,991	17,762
Less : operating payments	1,560	1,890	2,848	2,594	3,029	2,960	3,034	17,915
Less : capital payments	99	84	118	144	226	238	250	1,159
Less : interest payments	17	38	47	54	56	66	94	372
Less : tax payments	7	7	13	13	11	10	5	66
Less : dividend payments	9	3	-	-	-	-	-	12
TOTAL CASH DEFICIT	(89)	(217)	(191)	(248)	(291)	(334)	(392)	(1,762)
Historic cost loss after tax and dividends	(24)	(124)	(44)	(52)	(38)	(145)	(536)	(963)
Cssh flow deficits expressed in 1980 prices	(217)	(420)	(327)	(361)	(394)	(391)	(392)	(2,502)

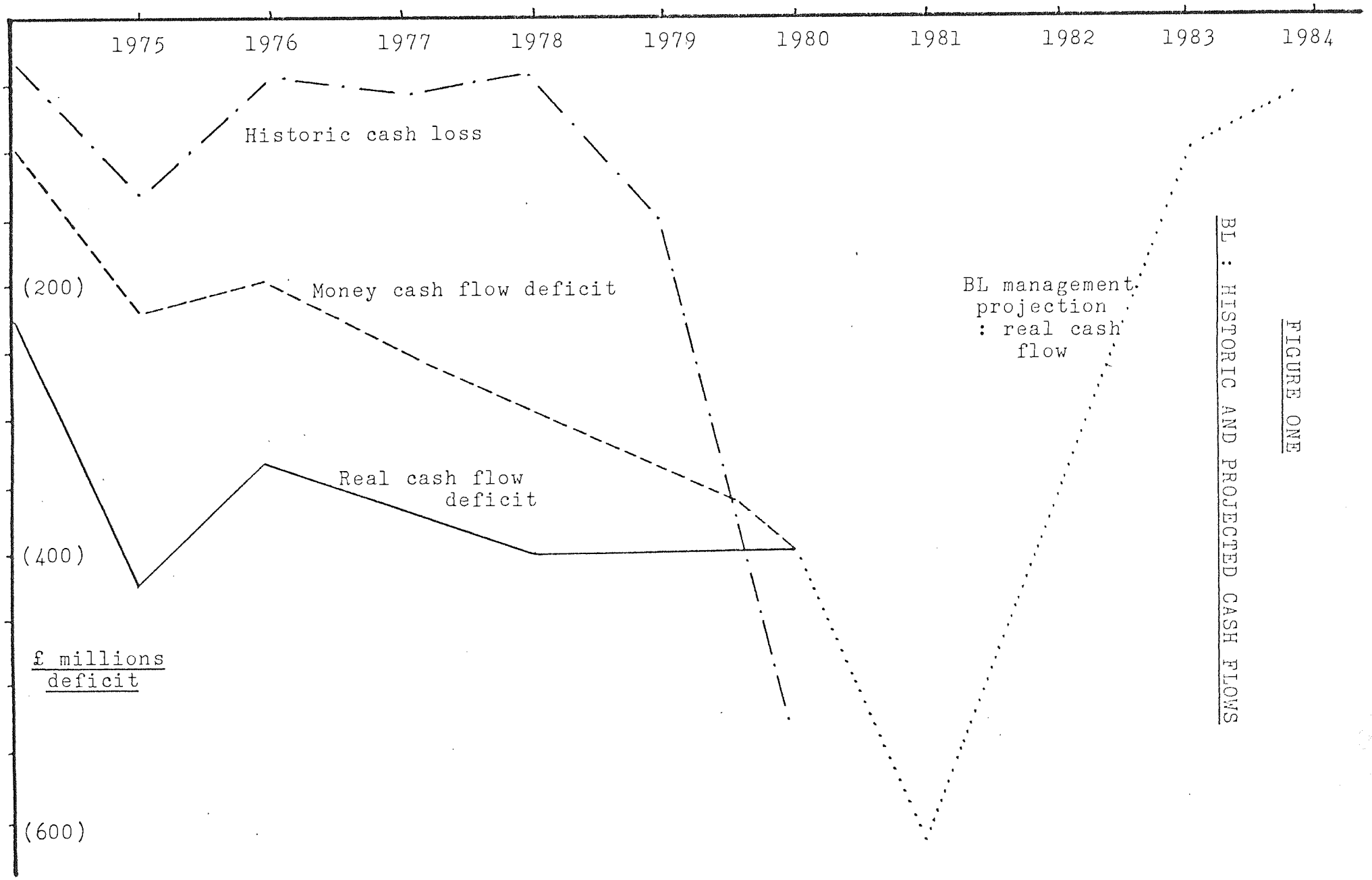
TABLE THREE

FORD U.K. CASH FLOWS : 1974-1980

(£ million)

	1974	1975	1976	1977	1978	1979	1980	Total
Operating cash flow	(55)	71	133	169	341	469	441	1,569
Less : new investment	49	45	49	75	147	295	279	939
Less : tax paid	7	4	7	20	43	56	58	195
Less : dividend paid	10	-	-	15	78	135	-	238
Cash surplus (deficit)	(121)	22	77	59	73	17	104	435
Total accounting profit	2	7	44	116	41	212	204	626

'Operating cash flow' = Sales receipts less operating payments.



BL : HISTORIC AND PROJECTED CASH FLOWS

FIGURE ONE

APPENDIX TWO

PRODUCTIVITY SUB-COMMITTEE : FINDINGS

A summary of the Productivity Sub-committee's report reads as follows ;

1. For reasons of disputes/lay offs,late starts/early finishes and a higher relaxation allowance,the BL workforce were effectively available to do productive work for a substantially short time than their continental counterparts in Renault,Simca and Volkswagen.

BL workforce available : 72% of working year

European average : 80% of working year

2. When BL workers were actually available for work, a much greater amount of their time was spent non-productively.

Productive time at work (excluding disputes)

BL workforce : 54% of available time

European ave. : 79% of available time

3.Of the non-productive time that was 'accepted', i.e. attributable to management,BL had a much higher percentage than Volkswagen,and the same applied to 'excess',i.e. unnecessary,non-productive time.

3. 'Accepted' non-productive work time

BL : 22%

Volkswagen : 8%

'Excess' non-productive time

BL : 13%

Volkswagen : 3%

4. In terms of production volumes in Body and Assembly, Longbridge could only achieve 68% of its manned capacity against the European average of 98%.

5. Output per operator in Longbridge Body and Assembly was 55% of the Volkswagen level.

By collecting all these figures together in Table One, the overall inadequacy of BL's production efficiency is underlined, with uncompetitive levels of productivity being recorded on every possible measure.

TABLE ONE

Summary of Productivity Sub-committee report

		BL	European ave.
Effective work-force availability (%age of working year)		72%	80%
Achievement of manned capacity	Powertrain	74%	98%
	B&A	61%	98%
Output/operator (VW = base index of 100)	Powertrain	67%	95%
	B&A	48%	97%
Productive use of time	Powertain	53%	79%
	B&A	38%	80%

APPENDIX THREE

BL AND FIAT : TECHNICAL DEVELOPMENT

Table One presents a short outline of the progress of technological change in both BL and Fiat over the period 1958 - 1980, focussing on developments in the BIW area. Essentially, this survey reveals that, in contrast to BL who even by the late 1970's had made only tentative steps towards the use of robots, Fiat's experience of all forms of mechanization in the BIW process shows a continuous line of development from the early 1960's onwards. This long record of technical advance, culminating in the advanced 'Robogate' systems in 1978, meant that Fiat had a great deal of experience in dealing with the technical problems thrown up by mechanized BIW systems. In particular, with each new phase of development Fiat were able to add to their technological skills and capabilities. For instance, although there were major technical difficulties with the firm's first mechanized assembly/framing jig - too high a transformer density and attendant maintenance problems - Fiat were able to profit from the experience of having to solve such problems. For the 131 model the assembly jig was further refined and given greater flexibility to circumvent such design flaws. Further, after successive refinements of their

multi-welder technology,Fiat found that,under increasingly uncertain market conditions,its inherent dedication constituted a major obstacle to efficient production. However,given that Fiat's engineers had been developing industrial robots since the early 1970's,the technical solution was already at hand,and Fiat were able to secure the maximum degree of production flexibility by applying robots to all phases of the body-framing process.The so-called 'Robogate' system in which this design feature was incorporated came to represent the apex of technological development in the European motor industry,effectively signalling the success of Fiat's long record of progressive,incremental innovation.

Sources : Visit to Fiat's Rivalta plant,March 1980 and C.Besusso (Fiat),New Job Design in Italian Car Manufacturing (mimeo)

TABLE ONE

BL v. Fiat : BIW technologies

BRITISH LEYLAND	FIAT
1958 : Static build, box-jig system installed at Longbridge for Mini. Low volume, little mechanization.	
	1961 : Underframe transfer welding machine for new 1300. Workers position parts but welding mechanized.
1964 : Extensive mechanization and use of multi-welders for Austin 1800 at Castle Bromwich. Sales forecasts grossly inflated, under capacity working.	
	1965 : Pneumatic clamping of whole body-shell is introduced, but welding manual. More extensive use of multi-welders for body sides, roofs and doors.
1968-69 : Purchase of Unimate and Versatran robots, and installation of former at Cowley for evaluation.	
1969-70 : £1 million investment in Sciaky Underframe multi-welder for Marina at Cowley. Series welding (quality problems) and transformers too densely packed. Operator paced working.	
Introduction of 'Gateline' from USA ; moving jigs, highly labour-intensive but higher volume than the Static build.	
1972 : 'Butterfly Gateline' installed for Allegro at Longbridge.	1972 : For 120 model automation extended to assembly jig.

TABLE ONE

BRITISH LEYLAND	FIAT
	1972 : Mechanized welding of both tack and spot welds for 120 model. But technical problems - too high a density of transformers.
	1974 : 16 robots installed at Mirafiori plant to perform re-spot welding of 132 model.
(1975 : 'Future Body Build Systems' report recommends choice of Automated Body Framing for future BIW investments.)	1974 : For 131 model the assembly jig divided into two mechanized stations, and a degree of flexibility - could weld two different models.
(1975 : Collapse of BL, Ryder Report proposes the modernization of facilities)	23 robots installed after framing jig for re-spot welding.
(1976 : BIW design for the AD088 drawn up in the 'Red Books')	
	1977 : 'Robogate' system at Rivalta and Cassino plants. Replaces serial and dedicated welding stations with parallel robotic stations, served by around 50 computer-controlled 'Robocarrier' trucks carrying clamped bodies.
1978-80 : installation of new technologies at the Longbridge plant.	Only 30% of system is dedicated to a particular model.
	1978 : 'Robogate' systems come on stream.
1980 : Metro BIW plant comes on stream.	

APPENDIX FOUR

MAINTENANCE TRADES' I.R. AGREEMENTS

There is no way of being sure that the collection of Industrial Relations agreements held by the Maintenance I.R. Manager was entirely complete or representative, for many agreements were made at Unit level and thus did not apply to the whole of the plant. On the other hand, the total of 73 different agreements and 'understandings' held by the Maintenance I.R. Manager can be regarded as probably the best possible indication of the nature of management-trade relations in the period before the imposition of the Draft Agreement.

The earliest of the agreements in the collection - all of which remained valid up to April 1980 - was one dating back to 1964. The range of issues covered by the agreements was very wide, touching on subjects such as ; special payments for particular kinds of work

removal of machine guards - who removes them and under what circumstances

lubrication - who performs it

provision of safety footwear

rules governing overtime

the contracting of work to outside firms

The agreements were distributed amongst the different trades as follows ;

Jig and tool fitters	: 3
Millwrights	: 8
All trades/between trades	: 9
Machine tool fitters	: 10
Pipefitters	: 11
Toolroom	: 14
Electricians	: 18

Running through the various agreements and understandings are the job rights and demarcations which the maintenance trades had been able to establish in the conduct of their work.For instance,an agreement on the removal of machine guards made in 1974 ran to the effect that ; "To obtain access to any electrical work,the electricians would remove all covers that do not have any mechanical parts attached to them or handles with or without gaskets." Or from 1976,a simple acceptance of demarcation ; "We (i.e. management) accept that there are two separate trades on the Longbridge site,namely Jig and Tool and Machine Tool fitting." The Unit 3 Pipefitters had been able to obtain explicit recognition of a number of their working practices in an 'Understanding on Custom and Practices' made in 1974.For instance :

"Will not work on sewage pipework or pumps, pits etc."

"Will not work above lights on nights."

"Will not make up or screw pipework for Toolroom to install."

But while the agreements reflect the job controls established by the maintenance workers, they also reflect the managerial interest in ensuring the close regulation of the trades' practices. A slightly absurd, but nevertheless revealing example of this interest comes from a 1974 agreement made at the Cofton Hackett plant, subject "Seating provision electricians' pen" :

Clause Two ; "..management accepts sitting can take place if there is no work available and not as a right between jobs."

Clause Three ; "Sitting is construed as a reasonable upright posture at normal chair height. No lounging or lying."

What is 'construed' as sitting may seem fairly trivial in itself, but it expresses fairly well the general texture of the relationship between management and the maintenance trades : a closely detailed and formalized relationship where the rights and the obligations of each side are formulated in the finest print. When management attempted to sweep away this whole intricate pattern of arrangements and understandings in April 1980, they were thus attempting a major attack on the trades' autonomy and practices.

INTRODUCTION : NOTES AND REFERENCES

(1) The literature on innovation is extensive but two examples can usefully be cited ;
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(8) J.Child, 'Organization structure, environment and performance : The role of strategic choice', Sociology, Vol.6 no.1, pp.1-22

(9) H.Braverman, Labor and Monopoly Capital : The Degradation of Work in the Twentieth Century (Monthly Review Press, London 1974)
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(13) S.Myers and D.G.Marquis, Successful Industrial Innovations (National Science Foundation, NSF 69-17, Washington 1969)

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(21) G.F.Stigler, 'The Economies of Scale' in D.Needham, Readings in the Economics of Industrial Organizations (Holt, Rinehart and Winston, London 1971), pp.110-128, p.112

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(29) International Management, July 1978, p.16

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(31) Visit - to Ford Halewood, Sept.1980

(32) A.E.Owen, 'Economic criterion for robot justification', Industrial Robot, Vol.7 no.3 (Sept.1980), pp.176-177, p.176

(33) Press release - from Ford management, Sept.1980

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(35) J.Engleberger, Opening address, 5th Conference on Industrial Robot Technology, Milan, 5-7 March 1980

(36) General Motors' projected 'World Car'

(37) H.Shaiken in The Nation, 11.10.80, p.36

(38) General Motors, 1981 General Motors Public Interest Report

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(40) An alternative to negotiations for some firms was to implement technological change in a covert manner. The European Marketing Manager of Unimation Inc., the world's largest robot manufacturer, admitted that on many occasions Unimation engineers had been requested by clients to conceal their activities, posing as 'Heating and Ventilation Engineers', and so on.

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(48) General Motors, 1981 General Motors Public Interest Report

(49) Interviews - with Renault and Fiat management, 1980

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(10) K.Bhashkar, The Future of the UK Motor Industry (Kogan Page, London 1979)

(11) BL internal documents

(12) P.J.S.Dunnett, op.cit.

(13) Society of Motor Manufacturers and Traders, Annual Reports

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(15) J.Redwood, Public Enterprise in Crisis (Basil Blackwell, Oxford 1980), p.167

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ibid.,pp.167-168

(17) Ryder Report,op.cit.

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K.Bhashkar,BL - Tomorrow's Economic Miracle ? (Sewells and Associates,Bath 1980),p.17

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House of Commons,Third Report from the Industry and Committee,Session 1980-81 (HMSO,London 1981)

(28) This involved a further £430 million government aid for BL over the period 1980-84,and £205 million of this was to meet plant closure and redundancy costs.

(29) See Financial Times,21.12.79,p.1 and Guardian,16.10.79 According to a high level ASTMS memo (acquired through Press sources),in September 1979 at a meeting with the trade unions Mike Carver,BL's Director of Business Strategy,put the chances of the company receiving further government aid at less than 50-50.

(30) Financial Times,8.10.80,p.22

(31) Financial Times,30.7.80,p.13

(32) Financial Times,8.10.79,p.I and 13.10.80,p.1

(33) According to the ASTMS internal memo (dated 27.9.79),the production targets for the Metro had to be cut back by one third because of "adverse reaction by the public to the name of BL".

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(35) ibid.

(36) As defined in the AUEW/TASS and T+GWU report, British Leyland : The next decade (London 1981)

(37) Financial Times,8.10.80,p.22

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(39) K.Bhashkar,The Future of the UK Motor Industry (Kogan Page,London 1979)

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(41) ibid.

(42) Internal Seminar,Napier College Edinburgh,2.2.82

(43) See various Financial Times articles on the 'World Car' ; 14.8.79,p.12 ;17.8.79,p.9 ;20.8.79 p.7 and 26.9.80.
As Motor Business noted in 1978 ; "Until fairly recently development of European-based manufacturers along national lines had not been a notable weakness for them...However,the effects of a slowdown in the rate of growth,a reduction in the scope and application of tariff barriers and a rapid rise in the competitiveness of other motor industries..have all combined significantly to alter the current position."
Motor Business,First Quarter 1978

(44) The complete list runs as follows : Austria, Belgium, Canada, Denmark, England, Finland, France, Germany, Italy, Japan, Netherlands, N. Ireland, Norway, Spain, Switzerland, and the U.S.A.
The U.S. Automobile Industry 1980, Report to the President from the Sec. of Transportation (U.S. Dept. of Transportation, Washington 1981), p.57

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(46) Economist, 19.11.60, p.803

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(48) ibid.

(49) Motor Business, Ist Quarter 1978

(50) Financial Times, 3.9.80, p.16

(51) Eurofinance, BL Appraisal Part II (Eurofinance, Paris 1980)

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(53) Eurofinance presented the following analysis of cost structures for selected European producers :

	GM	VW	Opel	Renault	PSA
1.Bought out materials	64	60	64	61	57
2.Labour costs	32	31	29	26	28
3.Other	4	9	7	13	15

(All as a %age of cost of sales)

Eurofinance Report, op.cit., Annex 2

(54) ibid., Annex 2
The technical flexibility of robots offered to reduce the minimum efficient scale for car assembly, but this effect was more than counterbalanced by the importance of economies of scale in components production.

(55) ibid., Annex 2

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(57) T+GWU, internal memo, 12.6.80

(58) Third Report from the Industry and Trade Committee, op.cit.

(59) Eurofinance Report, op.cit., p.3

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(6) A term defined by Fox in Beyond Contract : Work Power and Trust Relations (Faber and Faber, London 1972)

(7) As defined by the Eurofinance Report, BL Appraisal Part I (Eurofinance, Paris 1980)
See also New Statesman, 15.2.80, pp.232-233

(8) Note Ford's ability as a multinational to develop an efficient international manufacturing and supply network. See New Statesman, 17.8.79, p.227

(9) R.J.Overy, William Morris ; Viscount Nuffield (Europa, London 1976)

(10) R.Church, Herbert Austin : The British Motor Car Industry to 1941 (Europa, London 1979)

(11) ibid., p.102

(12) ibid.

(13) ibid.

(14) H.A.Turner, G.Clack and G.Roberts, Labour Relations in the Motor Industry (Allen and Unwin, London 1967)

(15) ibid.

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(19) D.G.Rhys,op.cit.

(20) ibid.

(21) D.J.Jones and S.J.Prais,'Plant Size and Productivity in the Motor Industry : Some International Comparisons',Oxford Bulletin of Economics and Statistics,Vol.40 (May 1978),p.142

(22) Dunnett,for example,emphasizes the effect of government policy,with the government's fluctuating use of the industry as an economic regulator preventing the long-term expansion which the Continental producers enjoyed.
See P.J.S.Dunnett,The Decline of the British Motor Industry : The effects of government policy (Croom Helm,London 1980)

(23) H.A.Turner,G.Clack and G.Roberts,op.cit.

(24) Even the unofficial company-wide combine of shop stewards did not act as a cohesive or centripetal force,but was,as Salmon notes,only "a policy making body devoid of executive power".
J.Salmon,'The vulnerability of Derek Robinson', New Statesman,4.1.80,p.16

(25) D.G.Rhys,op.cit.

(26) R.Church,op.cit.,pp.100-101

(27) As Turner et al. note ; "In the presence of a generally continued high employment..rising productivity and..a system of engineering collective agreements which has substantially failed to adapt itself to the recent growth and specialization of the negineering industries,the national agreements negotiated by official union leaders have come to serve only as a framework,a basis of minimum standards..on which employment conditions have been negotiated at the workplace level itself."
H.A.Turner,G.Clack and G.Roberts,op.cit.,p.205

(28) D.Robinson in 'Interview with Derek Robinson', Marxism Today,March 1980,pp.5-10

(29) G.Turner,The Car Makers (Eyre and Spottiswoode, London 1963),p.85

(30) In 1966 Jack Scamp's Motor Industry Joint Labour Council,reporting on industrial relations problems at Morris Bodies and Standard Triumph in Coventry, concluded that such problems were linked to the plants' piecework payment methods. J.P.S.Dunnett,op.cit.

(31) J.Salmon,op.cit.

(32) P.Lowry,The attempt to reform British Leyland's Industrial Relations (Institution of Production Engineers,Viscount Nuffield Memorial Paper, Loughborough 1975),p.2

(33) ibid.,p.3

(34) ibid.,p.3

(35) ibid.,p.4

(36) Economist,3.7.71,p.70

(37) P.Lowry,op.cit.,p.5

(38) Fourteenth Report from the Expenditure Committee, The Motor Vehicle Industry,Session 1974-75 (HMSO,London 1975),p.78

(39) Bhashkar notes that in the period after Ryder there was little modernizing investment in BL until the arrival of Sir Michael Edwardes. K.Bhashkar,BL - Tomorrow's Economic Miracle ? (Sewells and Associates,Bath 1980)

(40) Including management's own reports.See also New Society,27.10.77

(41) Central Policy Review Staff,The future of the British Car Industry (HMSO,London 1975),p.102

(42) House of Commons Expenditure Committee,op.cit.,p.78

(43) A.Flanders,'Measured Day Work and Collective Bargaining',British Journal of Industrial Relations Vol. XI (1973),pp.368-392,p.377

(44) N.Boulter,'Where a lack of incentives is a barrier to productivity' ,Guardian,13.11.79,p.24

(45) The situation is encapsulated in the following quote from Gouldner : "The demands for predictability and control lead to the use of impersonal rules which reduce the 'visibility' of power relations between supervisors and supervised.At the same time such rules define certain standards of performance : under certain conditions this depresses behaviour to the minimum level."
A.Gouldner in P.Bowen,Social Control in Industrial Organizations (Routledge and Kegan Paul,London 1976) p.36

(46) As described in Institute for Workers' Control, Motors Group,A Workers' Enquiry into the Motor Industry (I.W.C.,London 1978)

(47) D.Robinson in Marxism Today,op.cit.,p.5

(48) As described by H.Beynon in Working for Ford (Penguing,Harmondsworth 1973)

(49) Longbridge Operations,Direct Workers Agreement (I.R.Department,Longbridge 1975),p.7

(50) ibid.,p.8

(51) Ford Motor Co.Ltd.,Agreements and Conditions of Employment,Hourly Paid Employees,p.74

(52) ibid.,p.74

(53) BL internal document,The Personnel Aspects of the ADO88 programme (Draft Three,July 1976),p.31

(54) As defined by A.Fox in A Sociology of Work in Industry (Collier-Macmillan,London 1971)
Fox counterposes 'unitary' and 'pluralist' conceptions of management-worker relations.

(55) An analysis of this duality of business organizations is contained in S.Clegg and D.Dunkerley, Organization,Class and Control (Routledge and Kegan Paul,London 1980)
Also Batstone et al. note that the "network of rules,targets and constraints" which management operate within "is not,however,merely an aid to goal achievement.It is also a means whereby a particular power distribution is maintained between management and workers."
E.Batstone,I.Boraston and S.Frenckel,Shop Stewards in Action : The Organization of Workplace Conflict and Accomodation (Basil Blackwell,Oxford 1977)p.155

(56) Ryder Report, British Leyland : The Next Decade, A Report presented to the Sec. of State for Industry by a Team of Inquiry led by Sir Don Ryder (HMSO, London 1975)

(57) By the beginning of the 1980's the same sort of idea had re-emerged in a number of major car producers, often with the aim of following the model of 'quality circles' established by the Japanese industry.

(58) Ryder Report, op.cit., p.37

(59) New Statesman, 2.5.75

(60) BL internal document, Report of the Productivity Sub-committee, p.2

(61) ibid.

(62) In May 1978 the first major step towards rationalization was taken with the closure of Speke no.2 plant on Mersyeside.

(63) On becoming chief executive at BL, Edwardes quickly replaced many of the existing senior management with his own appointees. The remaining executives were subjected to a battery of psychological tests to determine their fitness for the task ahead.

(64) BL internal document, A Review of BL performance in 1982 and the BL 1982 Corporate Plan

(65) The year's plant-based bargaining cycle used to run as follows ;
January - Solihull (Rover)
February - Castle Bromwich
- Cowley
- Swindon (Pressings)
March - Swindon (Toolmakers)
April - Coventry (Jaguar)
May - Liverpool (Triumph)
July - Coventry (Triumph)
October - Drews Lane
November - Coventry (Rngines)
- Longbridge
Economist, 8.10.77, p.124

(66) Sir Michael Edwardes, The Management of Change, (The Second Lubbock Lecture on Management, Egham Surrey, 1981), p.11

(67) Sir Michael Edwardes, op.cit., p.4

(68) D.Robinson in Marxism Today, op.cit., p.8

(69) According to the Sunday Times, one senior trade unionist saw Robinson's dismissal in the following way ; "Robinson was dismissed because the recovery plan had got very tight timescales on it, and very tight targets...the higher management at Longbridge were sensitive to that and saw what Robbo was doing. They were petrified with the disruption that he was causing and said there was no alternative : he must go."
Sunday Times, 10.2.80, p.72

(70) H.Beynon, What Happened at Speke ? (T+GWU pamphlet, Liverpool 1978), p.29

(71) BL internal document, BL Cars Company Statement to JNC (Joint Negotiating Committee), 31.10.79, p.10

(72) BL Cars, Final Draft of Proposed Agreement on Bargaining, Pay, Employee Benefits and Productivity

(73) Financial Times, 20.2.80, p.10

(74) Financial Times, 18.4.80, p.1

(75) BL Cars, Company Statement to JNC, p.1

(76) ibid., p.2

(77) BL internal document, BL Corporate Plan 1980

(78) See the Financial Times, 16.4.80, p.6

(79) House of Commons, Third Report from the Industry and Trade Committee, Session 1980-81 (HMSO, London 1981)

(80) ibid., p.29

(81) Sir Michael Edwardes, op.cit., p.5

CHAPTER SIX : NOTES AND REFERENCES

(1) C.F.Carter and B.R.Williams, Investment in Innovation (Oxford Univ. Press, London 1958), p.39

(2) British Leyland : The Next Decade, A Report presented to the Sec. of State for Industry by a Team of Inquiry led by Sir Don Ryder (HMSO, London 1975), p.28

(3) This was not only technically desirable but also in accord with the policy of the Longbridge trade unions who were anxious to maintain employment levels at the plant.

(4) AD088 Programme Submission, Executive Summary, Section 5
This internal management document served as the basis for management planning of the changes in technology at Longbridge. It was known as the 'Red Book'.

(5) 'Competitive' being defined mainly by reference to the productivity standards achieved by Ford in manufacture of the Fiesta - the AD088/Metro's greatest rival in the U.K. market. In order to secure this level of productivity, the Red Book notes that "tooling proposals...maximise automation opportunities and reduce direct man-hours per car to the lowest level possible".
Red Book, op.cit., Section 5
The forecast production volumes enshrined in the Red Book ran as follows :

1980 ; 3595 per week
1981 ; 5544
1982 ; 5700
1983 ; 5983
1984 ; 6031
1985 ; 6065

These net volumes of weekly output explain why a gross capacity of 6500 per week was installed in the New West.

(6) Interview, Senior BIW Engineer, 13.5.80

(7) Red Book, op.cit., Section 5

(8) Interview, Senior Electronics Engineer, 13.11.80

(9) Interview, Senior Project Manager, 17.8.79

(10) AD088 Programme Submission, Volume One, Attachment 16

(11) The legacy of under-investment lay not only in obsolete machinery, it also deprived Longbridge of operating and maintenance experience with new automated technologies.

(12) Red Book, op.cit., Section 5

(13) Interview, Senior Project Manager, 20.1.81

(14) D.Salerni, 'Le pouvoir hierarchique de la technologie', Sociologie du travail, no.1 1979, pp.4-19, p.6

(15) Interview, 20.1.81, Senior Project Manager

(16) Interview, 13.5.80, Senior BIW Engineer

(17) Interview, 17.8.79, Senior Project Manager

(18) AD088 Programme Submission, Volume One, p.7

(19) ibid., p.6

(20) Interview, Senior Project Manager, 14.7.80

(21) Interview, Electronics Engineer, 24.7.80

(22) Red Book, op.cit., p.2

(23) BL internal document, Future Body Build Systems

(24) Under the ABF (III) system, each framing line was supplied with sub-assemblies from separate mechanized processes within the plant - each of the two lines, for example, being linked to a separate Kuka Underframe machine. As a result, a two module system could continue to operate at 50% even when one 'module' had broken down.

(25) Interview, Senior Industrial Engineer, 2.4.80

(26) It was the option enshrined in the original Red Book submission.

(27) One of the senior project managers had visited the Ford Kansas City plant where a system in some ways similar to the ABF I proposal had been installed ; the technical problems of the Kansas City system reflected badly on the ABF I option.

(28) T.Kynaston Reeves,B.A.Turner and J.Woodward, 'Technology and Organizational Behaviour' in J.Woodward,Industrial Organization : Behaviour and Control (Oxford Univ. Press,London 1970),pp.3-17,p.5

(28) BL internal document,A Review of BL performance in 1981 and the BL 1982 Corporate Plan,clauses 66-67

(30) If anything the BIW plant conforms to the 'segmental' stage of production described by Utterback and Abernathy ; being "mechanized and rigid.Tasks become more specialized and are subjected to more formal operating controls.Some sub-processes may be highly automated with process specific technology,while others may be still essentially manual".
J.M.Utterback and W.J.Abernathy,'A dynamic model of Process and Product Innovation',Omega,Vol.3 no.6 (1975),pp.639-656,p.641

(31) BL internal document,Automated Panel Store, Justification,Appendix II,p.2

(32) Severe problems arose during the commissioning process for the APS,and the computerized controls were a major part of these difficulties.As late as the summer of 1981,several months after the launch of the Metro,the APS was still not fully operational.

(33) Computing,24.4.80,p.10

(34) T.Caplow,The Sociology of Work (McGraw Hill,New York 1954),pp.27-28

(35) L.E.Davis and J.E.Taylor,'Technology,Organization and Job Structure' in R.Dubin,Handbook of Work, Organization and Society (Rand Mcnally,Chicago 1976) pp.379-419,p.412

(36) Interview,Senior Industrial Engineer,6.2.80

(37) Interview,Senior Industrial Engineer,2.4.80

(38) Interview,Senior Industrial Engineer,4.11.80

(39) W.L.Warner and L.O.Low,The Social System of the Modern Factory (Yale Univ. Press,New York 1947), p.254

(40) This aspect of the subordination of the subjective human element as implicit in mechanization seems to have been an element in Marx's thought.For example,Rosenberg summarizes Marx's analysis in the following way ; "The application of science to the productive process involves dealing with the impersonal laws of nature and freeing itself from all dependence upon the organic...It involves a degree of predictability of a purely objective sort,from which all uncertainties and subjectivities of human behaviour have been systematically excluded.Science,in short,can only incorporate its findings in impersonal machinery."
N.Rosenberg,Perspectives on Technology (Cambridge University Press,London 1976),pp.131-132
Further,some kind of empirical support for this view of technology comes from a study by Woodward ; "In unit production firms,mechanisms of control were relatively simple and unsophisticated.Control was exercised almost entirely through the personal authority pyramid.In all continuous flow firms,on the other hand,a framework of controls was created when the plant was built or the automated equipment installed."
T.Kynaston Reeves and J.Woodward,'The Study of Managerial Control' in J.Woodward,Industrial Organization : Behaviour and Control (Oxford Univ. Press,London 1970),p.39

(41) Interview,Senior Plant Industrial Engineer,17.8.79

(42) L.E.Davis,R.R.Canter and J.Hoffman,'Current job design criteria' in L.E.Davis and J.E.Taylor, Design of Jobs (Penguin,Harmondsworth 1972),pp.65-82, p.79

(43) W.Baldamus,Efficiency and Effort : An Analysis of Industrial Administration (Tavistock Publications, London 1961),p.46

(44) Interview,Senior Plant Industrial Engineer,17.8.79

(45) One of the Senior Plant I.E.s admitted that his department had clandestinely developed their own work standards for the new facilities at Longbridge, in preference to those produced by the Divisional Industrial Engineering function.He justified the development of these standards (which were somewhat 'tighter' than those laid down by Division) by reference to his department's greater local knowledge and a better concept of operator performance,

(46) Interview, Senior BIW Engineer, 13.5.80

(47) The figures, from internal documents, read as follows ;

High volume Underframe : 20.094 standard mins/car
Low volume (manual) : 79.184 standard mins/car

(48) Official figures released to the Press give manning levels over two shifts as follows ;
Metro ABF = 38 men, Conventional = 138

(49) During 1981, the first full year of production for the Metro, production volumes seem to have been mainly in the range of 4-4,500 cars per week - less than 70% of the plant's capacity, and barely sufficient to keep one of the two BIW 'modules' in full operation.
Kendricks notes that a plant's capacity utilization has an important impact upon the level of labour productivity.
J.W.Kendrick, Understanding Productivity (John Hopkins Univ. Press, Baltimore 1977)
Further, under-capacity working at the plant was bound to have important financial implications ; in effect, it reduced the return on investment and increased the plant's period of amortisation.
In 1981, D.G.Rhys, the economic expert on the House of Commons Trade and Industry Committee, commented on BL's evidence to the Committee to the effect that "although BL hopes as an imperative for survival to 'update models and facilities much more quickly than we have done over the last twenty years', the planned amortisation of the Metro production line is eight years, compared with three years in Japan"
House of Commons, Third Report from the Industry and Trade Committee, Session 1980-81 (HMSO, London 1981), pp.73-74

CHAPTER SEVEN : NOTES AND REFERENCES

(1) The need for trade unions to exercise some degree of control over technological change has been a consistent feature of recent trade union policies on 'new technology' - most notably in the T.U.C. Interim Report Employment and Technology (T.U.C.,London 1979)

(2) See G.Turner,The Car Makers (Eyre and Spottiswoode, London 1963)
The trade union official given a seat on the board of Chrysler was Doug Fraser,President of the UAW.

(3) A.Flanders,Management and Unions : The theory and reform of industrial relations (Faber,London 1970)

(4) R.Herding,'Job Control and Union Structure' in T.Clarke and L.Clements,Trade Unions in a Capitalist Society (Harvester Press,Hassocks Sussex 1978), pp.260-279,p.260

(5) J.P.Bolweg,Job Design and Industrial Democracy (Martinus Nijhoff,Leiden 1976),p.55

(6) A.L.Friedman,Industry and Labour : Class Struggle at Work and Monopoly Capitalism (Macmillan Press, London 1977)
R.Smith,'The maximization of control in industrial relations systems' in J.Purcell and R.Smith, The Control of Work (Macmillan Press,London 1976), pp.1-26

(7) H.Ramsay,'Cycles of Control : Worker participation in sociological and historical perspective', Sociology,Vol.11 (1977),pp.481-506,p.496

(8) D.Guest and D.Fatchett,Worker Participation : Individual Control and Performance (Institute of Personnel Management,London 1974),p.188

(9) P.Brannen,E.Batstone,D.Fatchett and P.White, The Worker Directors : A Sociology of Participation (Hutchinson,London 1976)

(10) ibid.,p.35

(11) ibid.,p.173

(12) Some of these aspects of legitimacy in participation are discussed in P.Selznick,Law,Society and Industrial Justice (Russell Sage,New York 1969)

(13) G.Turner, op.cit., p.20

(14) British Leyland : The Next Decade, A Report prsented to the Sec. of State for Industry by a Team of Inquity led by Sir Don Ryder (HMSO, London 1975), p.37

(15) The information presented here comes from three main sources. Firstly, attendance at four meetings of the AD088 Sub-committee in 1979. Secondly, a number of interviews with the managers and some of the trade unionists involved in the committee. Finally, access to the official Minutes of the AD088 Sub-committee's meetings.

(16) BL internal document, memo from R.Frearson (Plant Director) to J.Donaghy (Head of the Metro Project Team), 26.11.76

(17) Minutes of AD088 Sub-committee

(18) On one occasion the trade unionists on the committee did have some important points to make, regarding the undesirability of introducing a 'carousel' system of seat manufacture for the Metro. It is interesting to note that management later had some cause to regret rejecting the trade union advice on this issue, for during the early phase of production for the Metro the trade unions' doubts were confirmed by the outbreak of a major dispute in the 'carousel' area - sparked off by a conflict over productivity levels.

(19) D.Robinson, Industrial Democracy : The Leyland Experience, p.3
This is an article that was submitted to the New Statesman but never published.

(20) D.Robinson, J.Adams, V.Poulten, C.Willetts, 'Who can make British Leyland work ?', Comment, Vol.16 (1978), pp.250-254, p.254

(21) When a group of stewards from the AD088 Sub-committee were taken on a guided tour of the new facilities, their comments and questions were confined almost exclusively to topics like tea-making facilities and the Health and Safety aspects of the new lines.

(22) D.Robinson 'Industrial Democracy', op.cit.

(23) Interview, J.Adams, 28.8.80

(24) ibid.

(25) F.A.Heller (Tavistock Institute of Human Relations), O.Tynan (BL) and R.Hitchon (Shop Steward,BL), The Contribution of Employee Participation to Work Design : An Example from British Leyland
Reprint of paper presented to the International Industrial Relations Association Conference, (German Section),'Industrial Relations and Working Conditions on the Shop Floor' (Hamburg,7-9 Oct.1979) R.Hitchon,p.15
F.A.Heller and other members of the Tavistock Institute were involved in a cooperative arrangement with BL for the monitoring and study of the participation machinery.

(26) Interview,J.Adams,28.8.80

(27) F.A.Heller et al.,op.cit.,p.14 (R.Hitchon)

(28) One example from the Sub-committee minutes is the choice of a 'semi-automated table top system' for bodyside assembly in the BIW plant.In passing this proposal,the AD088 Sub-committee accepted without demur the managerial rationale for the system,which read as follows ;

1.Reduced risk of skin panel damage
2.Buffer storage facilities between certain stations
3.Less total floor area required
4.Possibility to automate the 80 manual welds at a later stage

Minutes,24.2.78

(29) Minutes,AD088 Sub-comiitee,7.1.77

(30) Ryder Report,op.cit.,p.39

(31) Guardian,9.4.79,p.19

(32) Ryder Report,op.cit.,p.39

(33) An internal management report underlined this need for management to accept compromise in the following,rather clumsy,way : "management must not accept that their preferences will not be modified by the participation process".
BL internal document,Study of Existing and Future Body Build Methods (Car Body Construction,Job Improvement Concept),Main Report no.P0001,p.15

(34) Interview,Senior Project Manager,17.8.79

(35) Main Report,no.P0001,op.cit.,p.15

(36) Interview, Project Manager, 15.5.80

(37) Interview, Project Manager, 24.4.79

(38) BL internal document, AD088 Joint Sub-committee, Report on a Visit to the Mirafiori Plant of the Fiat Car Group, Turin Italy (Sept.1977)
The findings of this visit differed little from a management report on the same subject ; Report on a Visit to the Mirafiori Plant of the Fiat Car Group, Main Report no.P0007

(39) Interview, F.A.Heller (Tavistock Institute), 13.4.81

(40) According to Frank Heller, the participation system at Longbridge allowed changes to be discussed and installed which otherwise, given the balance of power at the plant, could not have been secured.

(41) Birmingham Evening Mail, 23.5.80, pp.6-7

(42) 'Interview with Derek Robinson', Marxism Today, March 1980, pp.5-10, p.6

(43) This basic contradiction between the conduct of participation and the shift in the power balance in BL found expression as a conflict between, on the one hand, the machinery of participation, and, on the other, the dynamics of collective bargaining. According to Frank Heller, "highly successful work within participation may be lost because no adequate method has been found for linking it up with wage structures".
F.A.Heller, O.Tynan and R.Hitchon, op.cit., p.21

(44) D.Robinson, 'Industrial Democracy', op.cit., p.4

(45) Guardian, 10.7.80, p.19

(46) J.Storey, The Challenge to Management Control (Kogan Page, London 1980), pp.24-25

(47) File on Four, B.B.C. Radio Four (7.45 p.m., 8.10.80)

(48) P.Brannen et al., op.cit., p.238

CHAPTER EIGHT : NOTES AND REFERENCES

(1) Interview, Radio Four, 8.10.80

(2) The most recent and probably the most extravagant Press reports come in the Sunday Times, 21.3.82, p.55

(3) Interview, J.Adams, 28.8.80

(4) A typical production 'team' would include : one foreman, one materials handler, one labourer, 21 direct production workers and 3 adjusters.

(5) Interview, Project Manager, 24.4.79

(6) BL internal document, Check List for Operating Requirement Changes for LC8

(7) BL internal document, Study of Existing and Future Body Build Methods, Main Report no.P0001, Summary

(8) Interview, Project Manager, 18.8.80

(9) BL internal document, Longbridge Agreement for Hourly Rated Workers ('Management of Change') 20.4.79, p.1

(10) ibid., Section 7

(11) ibid., Section 9

(12) ibid., Section 10

(13) ibid., Section 10

(14) For example, Study of Existing and Future Body Build Methods and Report on a Visit to the Mirafiori Plant of the Fiat Car Group, Main Report no.P0007

(15) Interview, Project Manager, 30.1.80

(16) A.Aldridge, Power, Authority and Restrictive Practices (Basil Blackwell, Oxford, 1976), pp.66-67

(17) BL internal document, Final Draft of Proposed Agreement on Bargaining, Pay, Employee Benefits and Productivity

(18) BL internal document, Implications of the Introduction in Changed Working Practices (April 1980), p.1

(19) See B.Burkitt,'Are trade unions monopolies ?', Industrial Relations Journal,Vol.8 no.2 (1977), pp.17-21

(20) 'Implications..' document,op.cit.,Section 5.1

(21) ibid.,Section 5.2

(22) British Leyland,Longbridge Establishment,Procedure Agreement,Hourly Rated employees (March 1976), Clause 2.5

(23) 'Implications..' document,op.cit.,Section 5.11

(24) ibid.,Section 5.11

(25) 'Draft Agreement',op.cit.,Appendix G

(26) Interview,Senior Industrial Engineer,3.6.80

(27) ibid.

(28) Interview,Industrial Relations Manager,17.6.80

(29) This applied with equal force to other areas of the plant.One of the T+FA stewards reported that management in that area were flouting and disregarding a number of important informal agreements and understandings on production methods and manning. Interview,T+FA steward,22.5.80

(30) BL internal document,I.R. Report,Unit One (Period Six,1980)

(31) Interview,Unit One Industrial Relations Manager, 30.10.80

(32) BL internal document,I.R. Report,Unit One (Period Four,1980)

(33) Interview,Unit One Industrial Relations Manager 5.9.80

(34) Interview,Production Foreman Unit One,14.10.80

(35) ibid.

(36) Interview,Unit One Personnel Manager,8.6.79

(37) Interview,Unit One Industrial Relations Manager, 30.10.80

(38) Interview, local AUEW officials, 9.5.80 and 29.5.80

(39) Interview, Production Foreman Unit One, 14.10.80

(40) Interview, Unit One Industrial Relations Manager, 5.9.80

(41) Interview, Production Manager Unit One, 5.11.80

(42) These agreed tea-breaks were of such long-standing character they could be traced back forty years.

(43) Interview, local T+GWU official, 11.7.80

(44) Interview, T+FA steward, 22.5.80

(45) Interview, J.Adams, 28.8.80

(46) ibid.

(47) The Sheet Metal Workers' jobs involved the linishing and finish gas welding operations on the Metro body-shells, rectifying any slight faults in the metal panels.

(48) 'Implications..' document, op.cit.

(49) Interview, Unit One Industrial Relations Manager, 16.7.80

(50) The recruitment problem brought the issue to a head, but the demarcation had been a cause for concern amongst management for a number of years.

(51) BL internal document, I.R. Report Unit One (Period Six, 1980)

(52) ibid.

(53) Interview, local SMWU official, 5.7.80

(54) Interview, Unit One Industrial Relations Manager, 16.7.80

(55) Interview, local SMWU official, 5.7.80

(56) BL internal document, I.R. Report Unit One (Period Nine, 1980)

(57) E.Hobsbawm, Labouring Men : Studies in the History of Labour (Weidenfeld and Nicolson, London 1964), p.170

(58) D.Elliott and R.Elliott, The Control of Technology (Wykeham Publications, London 1976), p.172

(59) In the summer of 1980, when the Longbridge Industrial Engineers tried to reduce the 32% Relaxation Allowance in the Paint Shop (originally conceded because of extremely poor working condtions there), to the maximum of 17% allowed by the 'Draft Agreement', the local T+GWU official and the Works Committee, in view of the prevailing weakness of the trade unions at the plant and the impending launch of the Metro, were forced to advise the Paint Shop workers to end their strike.

(60) R.Herding, Job Control and Union Structure (Rotterdam Univ. Press, Rotterdam 1972), pp.35-36

(61) A.Barr in the Sunday Times, 21.3.82, p.55

(62) In October 1980, just before the launch, the shop stewards in the New West were consulted about the technologies installed there. However, their comments related mainly to topics like the provision of lockers and tea-stations. At the very least this serves to indicate that the production work-force had little vested interest in the technical aspects of the plant.
BL internal document, Corrective Action Plan on Points raised by Supervisors and Shop Stewards

CHAPTER NINE : NOTES AND REFERENCES

(1) In this BL's engineers were following a strong technological trend in the industry.For example, in 1980 management at Ford's Halewood plant claimed that any one of the robots they employed for spot-welding could,if necessary,be removed and, within just one hour,substituted by another robot performing the same task.
Visit - to Ford Halewood,23.9.80

(2) These present a display indicating the machine's progress through each stage of its cycle.

(3) PLCs are a simple form of electronic control.In their distributed format they are less sophisticated than centralized computers,but of great utility in more routine tasks.As late as 1980 an internal BL report,Centralized Resistance Welding Control (Materials and Manufacturing Technology,29.4.80) favoured PLCs for future deployment in BL plants ; partly for their reliability and compatibility with possible microelectronic applications,but also for their ease of maintenance.

(4) Since their introduction at Renault Billancourt in 1971,centralized computer control systems for the BIW process had become increasingly popular in the industry.By 1980 the Sciaky firm had installed 30 such systems in European car plants.

(5) This emphasis on the socio-technical aspects of PLCs was further underlined by the report on Centralized Resistance Welding Control.

(6) As a general rule,the maintenance procedure would begin at Level Two,then Level One and finally,as the last resort,Level Three.

(7) Advertisement by Allen-Bradley,Financial Times, 30.7.80,p.14

(8) Interview,Senior Industrial Engineer,13.11.80

(9) The major problems with the Unimates centred on the breakdown of the robot 'wrists' under the strain of welding cable 'drag'.

(10) M.Crozier,The Bureaucratic Phenomenon (Univ. of Chicago Press,Chicago 1964),p.109

(11) J.Woodward, Industrial Organization : Behaviour and Control (Oxford Univ. Press, London 1970), p.35

(12) S.Clegg, Power, Rule and Domination (Routledge and Kegan Paul, London 1975)

(13) One of the firms supplying robots to BL demanded a degree level expertise in electronics amongst those responsible for maintenance. However, BL engineers claimed that HND level qualifications were sufficient.

(14) BL internal document, Employee Aspects of Modern Manufacturing Facilities, Report P0007, p.9

(15) At Fiat, according to another BL report, management had been able to go even further, actually abolishing the maintenance pens themselves ; "there were no pens on the line facilities whatsoever and, in fact, the maintenance men appeared to be constantly patrolling their facility."
AD088 Joint Sub-committee, Report on a Visit to the Mirafiori Plant of the Fiat Car Group (Sept.1977) p.5

(16) ibid., p.6

(17) At Longbridge a request for repair had to be communicated first to the production foreman, who would notify the maintenance foreman in the central pen, and he in turn would then initiate the maintenance procedure.

(18) Interview, Project Manager, 15.5.80

(19) Interview, Project Manager, 18.8.80

(20) The problems of Longbridge management were rendered even more acute by the constraints of the new centralized, corporate wage structure. This effectively forestalled any attempt to recruit more skilled workers by paying higher wages.

(21) The 'blacking' of training and commissioning work put the New West out of bounds to maintenance tradesmen throughout 1979 until October.

(22) Longbridge Agreement for Hourly Rated Workers ('Management of Change'), 20.4.79, Clause 12.8

(23) K.Liepmann, Apprenticeship - An Enquiry into its adequacy under modern conditions (Routledge and Kegan Paul, London 1960), p.158

(24) Interview, Maintenance Manager, 6.8.80

(25) Interview, Project Manager, 15.5.80

(26) Interview, Industrial Relations Manager, 17.6.80

(27) Interview, Project Manager, 15.5.80

(28) BL internal documents, Trade Overlap Proposals (22.5.80)

(29) ibid.

(30) ibid.

(31) AD088 Joint Sub-committee, Report on a Visit to the Mirafiori Plant of the Fiat Car Group

(32) Interview, Electronics Engineer, 1.10.79

(33) Interview, Project Manager, 15.5.80

(34) BL internal document, Meeting of M.T. and J+T Fitters to discuss Trade Overlap items, 10.7.80, p.2

(35) ibid., p.2

(36) They had even been able to consolidate additional tasks into the new grade. In particular, the Toolroom workers had been forced to give up the task of repairing water leaks in the multi-welders - a frequent cause of machine failure.

(37) Interview, Maintenance Manager, 6.8.80

(38) Interview, Maintenance Manager, 28.10.80

(39) Interview, Project Manager, 15.5.80

(40) BL internal document, Control Engineering function, Draft Proposals

(41) The Asea robots were employed in the BIW area for CO2 welding, the Trallfa robots for the spraying of 'underseal' in the Paint shop. The ISI communications system was a special co-axial cable which connected the various communication and monitoring technologies in the New West.

(42) Control Engineering function, Draft Proposals

(43) ibid.

(44) Interview, Senior Electronics Engineer, 13.11.80

(45) Interview, Electronics Engineer, 1.10.79

(46) Control Engineering function, Draft Proposals

(47) S.Clegg and D.Dunkerley, Organization, Class and Control (Routledge and Kegan Paul, 1980), p.465

(48) Interview, Maintenance Manager, 28.10.80

(49) BL internal document, Implications of the Introduction in Changed Working Practices, Unit One (April 1980)

(50) BL internal documents

(51) Implications of the Introduction in Changed Working Practices

(52) BL internal document, Minutes of Stage 3 Meeting with M.T.Fitters (4.9.78)

(53) ibid.

(54) BL internal document

(55) T.Elger, 'Valorization and de-skilling - a critique of Braverman', Capital and Class, Spring 1979, pp.58-99, p.70

CONCLUSION : NOTES AND REFERENCES

(1) The productivity increase at Longbridge seems to be partly attributable to the severe but cyclical effects of economic recession.As Kendrick notes : "Labour efficiency..seems to have a systematic cyclical component ; that is,productivity rises before the trough,as the profit squeeze increases management's cost consciousness and as rising unemployment motivates workers to value their jobs more highly and work more productively." J.W.Kendrick,Understanding Productivity (John Hopkins Univ. Press,Blatimore 1977),p.67

(2) Management's attempts to dimantle the union organization at Longbridge can usefully be located in the context of an empirical study conducted by Gale in the U.S.A..Gale found that businesses with a low degree of unionization (less than 20% of the work-force) were able to secure a higher productivity boost from large-scale capital investment than firms with a high degree of unionization (over 65%) undertaking comparable investment.The difference in productivity gains was of the order of 15%.
See B.Y.Gale,'Can more capital buy higher productivity?',Harvard Business Review,July-Aug 1980,pp.78-86

(3) The figures put forward by BL management read as follows : in 1980,132,000 cars were made by a work-force of 17,000,that is 7.7 cars per man p.a. In 1981 234,000 cars were made by 14,000 workers - 16.8 cars per worker,an increase of more than 120%. However,considering that most of the manufacturing processes remained labour-intensive,the greater part of this increase seems to have been at the expense of greater labour effort.
In 1981 the Sunday Times claimed that Longbridge workers found "the pace of an assembly line working to the maximum output of 4,700 Metros a week..too punishing".Further,one 40 year old worker described the work pace as follows : "The foremen keep at you all the time,and the cars keep coming down the track.People just don't understand the pressure we are under." As the newspaper article commented ; "the only reason he stayed was lack of other jobs in Birmingham".
Sunday Times,29.9.81,p.53

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