BREACHING THE MONOPOLY: TELECOMMUNICATIONS AND THE STATE IN BRITAIN

Kevin Morgan

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INTRODUCTION

Few organizations have had the potential to play a more significant role in both economy and society in Britain than the Post Office. Through its postal and telecom divisions it directly touched the lives of virtually everyone, making it unique among the nationalised industries. With the exception of central government it was the largest employer in the country, with close on half a million employees. Apart from the MoD it housed the largest R+D base for 'high-tech' in the public sector, if not in the economy as a whole. The investment programme of its telecommunications division was the major single source of public sector procurement in the civilian electronics industry and here it had untold potential for sponsoring innovation and promoting exports etc. For all this the Post Office appeared to move in mysterious ways. At times it seemed to be an empire unto itself. Public control over its actions, for example, was at best ambiguous and at worst chaotic, as we hope to show later. Although the issues considered here are confined to the telecommunications sector we believe that they raise more general questions regarding the scope and limits of different forms of government intervention; about the autonomy of the capitalist firm and the problems this can create for inter-firm collaboration; and about the balance of power between firms and government in public markets.

The following sections address a number of different issues:

(1) section one examines the making of a radically new telecom regime in Britain. Before 1969 the Post Office was a government department with a legal monopoly over telecommunications services; it was steeped in a bureaucratic civil service tradition and it was driven in no small way by an engineering type of culture. By 1984 the Post Office telecoms division had been transformed into a private company, free to pursue a commercially aggressive strategy but no longer having a legal monopoly;

(2) section two examines the changing relationship between the Post Office (later BT) and its equipment suppliers, a relationship which we loosely characterize as the 'telecom club' in the days before the new regime. Surprisingly, this relationship is relatively under-explored despite the fact that it constitutes one of the most important links between state and industry in the UK electronics sector.

(3) section three presents a case study in the management of technological change, focusing on the trials and tribulations of System X, the UK's digital switching system.

RE-MAKING THE TELECOM REGIME:TOWARDS LIBERALIZATION AND PRIVATIZATION

Prior to 1969 the Post Office was a revenue-earning department of government, internally governed by civil service conventions and externally subject to detailed Treasury and Parliamentary interventions. Its reputation for being a somewhat ponderous organization, ill-equipped to respond to the challenges of the 'white heat' of the technological revolution prompted the Labour government to convert it into a public corporation in 1969. This, it was hoped, would provide the Post Office with a greater degree of operating autonomy from central government, a hope that was to remain largely unfulfilled because governments continued to use the Post Office as a 'tool' of macro-economic policy.

The 1969 Act defined the general duty of the Post Office to exercise its powers so as to 'meet the social, industrial and commercial needs of the British Islands'(Section 9). To fulfill this duty it was given an 'exclusive privilege' to run the telecommunications network, including the power to decide the type of equipment which users could attach to the network. In addition the Post Office was given further powers, including the power to diversify into manufacturing for its own needs and the power to acquire subsidiaries.(Section 7). The Post Office exhibited a religious-like devotion to its monopoly, an important component of which was its 'integral network policy', which meant that all customer apparatus was to be supplied, installed and maintained by the Post Office. Three primary reasons were adduced in defence of this system. Firstly, it guaranteed the technical integrity of the network, which was 'complex and idiosyncratic'. Secondly, a free market in the supply of customer apparatus would lead to huge adaptation costs because foreign equipment had not been designed for the UK market. Finally, since switching, transmission and subscriber apparatus were becoming more inter-dependent, there was the growing need to think in terms of overall system development: technological trends therefore demanded more, rather than less, emphasis on an 'integral network policy'.(Post Office, 1976). In formal terms the 1969 Act had conferred a monopoly regime that was as comprehensive, if not more so, as anything to be found in Western Europe; indeed, some have claimed that the UK telecom market was 'the most closed within the OECD'. (Solomon, 1986). There were some important exceptions, the chief one being that business users could purchase large PABX's direct from the supplier - subject to Post Office approval - because these were often tailor-made for particular user needs.

The major actors within this regime were:

(1) the government, or rather the Department of Industry, which had 'sponsorship' responsibility for both the Post Office and the (private) equipment industry, and the Treasury, from

which the DoI had to seek approval for borrowing because this was part of the Public Sector Borrowing Requirement (PSBR). As the 'voice' of its two charges inside government the DoI not infrequently found itself in conflict with the Treasury over the scale of funds necessary for telecommunications development.

(2) the Post Office itself, or rather its Telecommunications Business division, which was subject to the control of a single Board, the latter also being responsible for Posts, Giro and Data Processing. This unitary structure increasingly came under fire from the Board, which (in a reversal of its position in the 1960's) favoured a complete separation of Posts and Telecoms because, it argued, the two were becoming ever more divergent as regards technology and managerial skill. Conflicts between the Board and its Telecommunications division were such that one cannot speak of the 'Post Office' as though it was a homogeneous actor.

(3) the Post Office unions between them accounted for 90% of a total workforce of over 400, 000 in 1976. In all there were 8 different unions, but the numerically dominant were the POEU, which represented technical and engineering staff, and the UPOW, which was responsible for postal workers, telephonists and telegraphists. Because these two unions were well-organized, powerful actors, both fervently committed to the practice of 'lifetime employment', the Post Office set a high priority on maintaining 'good relations' with them; so much so that it did not feel able to 'exert greater pressure on the unions to change practices which obstruct its policies'. (DoI, 1977:53). However, these two unions diverged on a series of issues: the POEU was all for separating Posts and Telecoms for reasons similar to the Board, while the UPOW remained passionately opposed to the notion, fearing that Posts would be left to wither on the vine.

(4) the equipment suppliers had been part of a 'telecom club' with the Post Office for decades: the most palpable expression of this club-like relationship were the Bulk Supply Agreements. These effectively committed the Post Office to an agreement to buy its equipment exclusively from an argreed 'ring' of private manufacturers. As we will see in section two, these private suppliers (GEC, Plessey and STC) were able to marshal formidable economic and political resources to defend and advance their positions vis-a-vis the Post Office under this regime even when the Bulk Supply Agreements terminated in 1969. Paradoxically perhaps, their power tended to be greatest under Labour governments.

(5) finally there were the users, formally represented by the Post Office Users' National Council (POUNC), which was established under the 1969 Act and which had the difficult task of representing both domestic and business users. Although the Post Office was obliged to consult POUNC it had no duty to act on POUNC's proposals; not surprisigly it was very much in the

Post Office's interests to advertise POUNC as a 'watchdog with teeth', a view not shared by POUNC itself. In fact a major review of the Post Office reported in 1977 that POUNC spoke 'from the sidelines', since it had inadequate resources and powers.(DoI, 1977). Apart from POUNC there were other user groups, like the Telephone Users Association, and the Telecommunications Managers Association, the latter consisting of the telecom managers of the major business users. However, the Post Office had no statutory obligation to consult with these 'outsider' user groups.

The aspirations embodied in the 1969 Act remained largely unfulfilled, especially as regards the hope that the Post Office would have greater operating autonomy from central government. No sooner had the Act been passed when a Conservative administration took office. Almost immediately the hopes of 1969 were dashed when a series of unprecedented government interventions ushered in a period of intense hostility between the new administration and the Post Office. By far the most important of these were (1) the sacking of the Post Office chairman because he tried to insist on the commercial freedoms which the Conservatives were proclaiming and (2) the refusal to allow telecommunication tariffs to keep abreast of escalating costs so as to contain inflation, proof that the Post Office was still being used as a macro-economic 'tool'. (POEU, 1976; Pitt,1980). Consequently, after 1971 Post Office finances deteriorated badly and in each of the three years to 1975 its telecommunications business recorded mounting deficits. So as to compensate for three years of price restraint several major tariff increases were packed into 1975 to restore profitability for 1976, provoking massive discontent from both domestic and business users. In addition to these interventions, the Post Office also had to contend with sudden cuts in its capital investment programme in 1973 and again in 1976, the former cut being imposed without any consultation with the Post Office. These interventions contributed in no small way to the growing unease over the Post Office's inability to satisfy residential and business demand. But external factors alone cannot account for such unease. For the POEU one of the major reasons for the Post Office's service problems lay in its 'continuing unprofessional approach to marketing and the survival in the Post Office of the Civil Service mentality'. This, it argued, was ultimately responsible for the failure to raise telephone density and the failure to identify and supply the advanced equipment which business users were increasingly demanding. (POEU, April 1976).

As a result of this growing unease over tariff hikes and service provision a major review of the Post Office was initiated by the new Labour government in 1975; its brief was to consider what changes, if any, were required to enable the Post Office to execute its functions more efficiently. It found, inter alia, that while the Telecommunications Business had much to be proud of, it was 'significantly less efficient than the best of its overseas competitors'.(DoI, 1977:19). Three of the major problems which it addressed concerned (1) the problematical

relationship between government and the Post Office (2) the unitary structure of the Post Office and (3) the Post Office monopoly.

On the first issue the Review echoed the findings of NEDO, which found that confusion reigned over the respective roles of government and corporation, with the result that accountability was seriously blurred; that there was no systematic framework to discuss and agree strategy; and there was no effective system to assess performance and managerial competence. (NEDO, 1976). One of the major problems in this relationship was the fact that informed intervention by the DoI was virtually impossible because it had so little knowledge of the Post Office business. Being devoid of independent information, and having made little effort to monitor overseas experiences, the DoI was inordinately dependent on information which the Post Office selectively chose to supply. Such a situation severely compromised the formal powers which the DoI had with respect to the Post Office. Although the Review refrained from saying so, there are grounds for saying that the DoI had been 'captured' by the Post Office. Nevertheless, the Review Committee were sufficiently troubled by the 'chaotic' manner in which interests were or were not represented in policy formation that it proposed a new Council on Post Office and Telecommunications Affairs. This was to consist of all the relevant actors and its proposed task was to supply the Secretary of State for Industry with independent and well-informed advice. (DoI, 1977:60).

As regards the second issue - the unitary structure of the Post Office - the Review strongly recommended that Posts and Telecoms should be separated into two formally distinct businesses. It reasoned that the two divisions were becoming more and more divergent as regards operating factors. Equally important it concluded that the unitary Board had led to over-centralization, poor delegation and slow decision-making, all of which had inhibited sound strategic thinking. (DoI, 1977:66). In fact strategic issues were decided upon by 'very few people' and the role of the Chairman was far too powerful. Nor was it just a matter of structure: in 1976 only three members of the Board had a telecommunications background. All this was seen to add up to a powerful case for formal separation.

Finally, on the question of the Post Office monopoly the Review Committee said it was 'not convinced that the balance of advantage to the community favours the continuation of the present monopoly situation in the UK'. It therefore recommended 'a cautious and controlled liberalization' in the supply of certain subscriber apparatus like PABX's. What precipitated this conclusion was the Committee's view that Post Office thinking was still geared to the provision of a standard and basic telephone service, an era when users were told precisely what they were allowed to have. That era, it argued, had largely passed because there was now a generation of business user in the UK which had considerable expertise and sophisticated needs, particularly in the field of data communications.

Furthermore, given the emergence of new telecommunications services, the Committee felt that the UK would be unable to harness these to the full unless the Post Office equipped itself with much greater managerial expertise, especially in the field of marketing. The Post Office, it concluded, knew too little about its customers' needs and customers felt that they were 'graciously permitted to use the systems'. For these reasons the Review called for a mild liberalization of PABX supply, because the US experience since 1968 had shown that customer-provided equipment did not actually harm the network, as the Post Office had claimed. However, anxious to protect domestic producers, the Committee said that liberalization should only be introduced at a rate that allowed UK manufacturers to become competitive in this liberalized market segment. (DoI, 1977:108).

The significance of the Review lies not in its immediate political impact - there was none, because the Labour government proved unable or unwilling to act upon it - but in the light it shed on the plight of the UK telecom regime. It also showed that some of the changes inaugurated later by the Thatcher government were not entirely novel. Nor were these later changes all reducible to Left-Right categories; the separation of Posts and Telecoms, for instance, was a long-standing demand of the POEU. Perhaps most importantly the Review threw up a challenge to the Labour Party to demonstrate that in a sector like telecoms, crucial to productivity and innovation throughout the economy, the Post Office could combine public accountability with greater efficiency in its provision of services and equipment. Labour governments had lamentably failed to be equal to this challenge. In the final year of the Labour government, in 1979, the POEU solemnly took note of 'a growing chorus of voices against the monopoly'. (POEU, 1979:88).

A less propitious conjuncture for the defence of the monopoly could not be imagined. The advent of a Thatcher government was sufficient of a threat in itself. Back in 1978 the Conservative Party had clearly promised that abolition of the monopoly of subscriber equipment would be one of the earlier acts of a future Tory government. Allied to this political threat was the fact that a huge 'log-jam' of equipment and service had built up, partly the result of the severe cuts imposed on the Post Office in the wake of the IMF crisis of 1976. Complaints from both domestic and business users had been escalating. POUNC recorded that complaints about excessive delays in the provision of service had virtually doubled between 1978-79 and doubled again the following year.(POUNC,1980;1981). For their part civil servants and ministers in the DoI were inundated with protest mail from both business users and 'ordinary folk'. On top of this there was mounting concern over the pedestrian performance of the UK telecom producers and their unhappy relationship with the Post Office in the 'telecom club'. As the Thatcher government saw it, Labour had failed to reform this club largely because it was overly committed to the monopoly regime, from which the private producers derived much of their bargaining power. A change of regime would weaken, if not destroy, this

club. All in all the situation was tailor-made for radical political reform, especially from the Right, because it lent itself to a credible critique which claimed that users were to be liberated from 'the dead hand of state control'.(DTI, 1983). The incoming government lost no time in adapting this tailor-made situation to its neo-liberal project.

Radical change presented the DoI with a major dilemma. Hitherto it had been almost totally dependent on the Post Office for information and advice on telecommunications. Well aware of the power associated with a virtual monopoly of technical expertise, the Post Office astutely used this power to further its own interests. Most of the traditional managers in the Post Office, especially those who were former civil servants, had little appetite for the changes on the horizon. (There was a conflict between these traditionalists and the new Chairman (Sir William Barlow) who was appointed in 1977 and who resigned in 1980. Barlow had been appointed by Callaghan to do a 'de-merger' on the Post Office. But, in the event, he found little support for the execution of his brief in either government or among the traditionalists in the Post Office, especially among those managers directly below Board level where there was a good deal of opposition to his scenarios.). Under new political masters the DoI team responsible for telecoms (the P+T division) was obliged to flesh out a new regime. The problem was that until then the DoI had accepted the advice of the Post Office as to what was or was not feasible. Now it was being invited to frame a new regime which threatened the Post Office to an extent that the latter could not be relied upon to offer 'neutral' advice. The traditional political network had clearly reached an impasse: it had 'worked' only so long as Post Office interests were not seriously threatened.

The DoI was well aware that liberalization along the lines suggested by the 1977 Review was neither hazardous nor contentious. But the same could not be said for licensing a private competitor in the basic network or for privatizing BT itself, both of which bordered on the unthinkable at the outset. Now, for the first time, the DoI set about mobilizing a body of expert opinion, independent of and often opposed to, the Post Office or BT as it became after the formal split in October 1981. This consisted of academics, former civil servants and, perhaps most important of all, major business users. The latter constituted a body of informed, if partisan, expertise - especially in the field of data communications - which could be used as a counterweight to that of BT itself. In fact business user groups like the TMA were amazed to find that, having had little access to either government or Post Office in the past, the government's doors began to fly open almost overnight after 1979. Thereafter the TMA was continuously invited to offer expertise and advice as an antidote to traditional, and by now discredited, sources. However, this major business user group was taken aback by the speed at which the government proposed to fashion a new telecom regime. Significantly, these business user groups never actually demanded that BT's basic network should be broken or that BT should be privatized in the way it was in 1984. Indeed, the initial TUA proposals for

liberalization (of subscriber equipment) actually said that the basic network monopoly should remain inviolate!. Clearly, in the changes that were to come the Thatcher government was by no means passively implementing the demands of major business users.

Among the new independent sources of expertise which the DoI used for feasibility studies was a small private consultancy, Microelectronics Design Associates (MDA). As early as July 1980 the DoI commissioned MDA to provide a technical briefing on the feasibility of a rival telecommunications network. A measure of the urgency which the DoI attached to such a study lies in the fact that it was produced within ten days!. Since it turned out to be very influential in and beyond the DoI it merits attention in itself. Eschewing what it referred to as a 'spurious sense of balance', because the Post Office was well equipped to defend itself, the MDA report articulated the serious concern among major business users with the Post Office monopoly and then argued that a rival private network was not only urgently needed but that it was technically and politically feasible. On the business user front the report underlined the particular threat to the City, where the the cost and inefficiency of Post Office services 'threaten to weaken London's strength as an international centre of commerce'.(MDA, 1980:9). Re-affirming the network under BT was not enough, it argued. If anything monopoly abuse was likely to increase because 'much effective power lies with the trade unions, and the POEU fully recognizes the increasing leverage it can exert in a monopoly'.(MDA, 1980:16). Finally, drawing on the US scene it argued that private finance for a private network would be forthcoming if the government so desired.

Fully aware of the provocative nature of its proposals, MDA emphasized the need for the 'capitalist network to have an acceptable face'. Its solution was for the government to allow a single bid from a broad-based private consortium of users and operators, so that risks would be minimised and the rival network could be seen to be in responsible hands. Its proposed mix of users and operators included the clearing banks, BP, ICI and Cable and Wireless. The overall thrust of the report was that a rival network competitor was not an arcane technical question, as the Post Office would have it, but a question of political will. Its influence with the new masters at the DoI was not at all surprising; having abandoned 'a spurious sense of balance', it was consciously designed to resonate in neo-liberal circles. The MDA report undoubtedly fortified politicians and pro-liberal civil servants in the DoI; above all it gave them more confidence to over-rule the Post Office's technically-shrouded view that the basic network was a 'natural monopoly'. Within months of the report being received the decision to create a second operator had been made. In June 1981 a consortium of Cable and Wireless, Barclays Bank and BP had publicly announced a plan to build and operate a rival network called Mercury. Was the government faced here with an unsolicited proposition?. Not at all.

The re-making of the telecom regime was a top political priority of the Thatcher governments between 1979-84. If the detailed process of reform spun out over 5 years, the fundamental proposals were all made in a remarkably short time. The period from September 1979, when the intention to implement the proposals of the 1977 Review was announced, to July 1982, when the sale of BT and the formation of Oftel were proposed, covered some 35 months. Allowing for the inevitable time-lag between proposals and prior decisions, the timescale for the latter was clearly much shorter. The government's declared aims for the new telecom regime are comprehensive. Among the major aims (or, more formally, the 'general duties' of the Secretary of State and the Director of Oftel) the duties are to:

(1) secure the provision of services throughout the UK, in so far as this is reasonably practicable, and to ensure that the service supplier is able to finance these services

(2) promote the interests of consumers, purchasers and other users in the UK

(3) maintain and promote effective competition between suppliers of telecommunications

(4) encourage major overseas users of telecommunications to locate in the UK

(5) enable UK telecom producers to compete effectively within and outside the UK (Section 3: Telecommunications Act, 1984).

This might be called the formal agenda of aims and, even on this level, it is clear that there is a good deal of conflict between some of these aims.(For example, between sponsoring the interests of consumers and producers at one and the same time. Although it is perhaps significant that producer interests appear last on the agenda.). One aim which is absent from this formal agenda is the aim of breaking the power of the POEU: the abolition of BT's monopoly and BT's subsequent privatization were the means through which the government hoped to achieve this less publicized aim.

As regards liberalization, which we distinguish from privatization, the government has introduced competition, albeit unevenly, in each of the three main segments of the telecom market, namely, (1) subscriber equipment (2) networks and (3) network services or value-added network services (VANS) as they are sometimes called. In the first of these the market has been almost totally liberalized. In the second segment liberalization has been more partial: only two national public

networks (BT and Mercury) will be licensed before 1989 in what is called 'basic conveyance'. However, the government has been more liberal towards networks serving specialized market segments. Here it has licensed two rival consortia (one led by BT, the other by Racal) to operate cellular mobile telephone networks in addition to licensing 11 cable TV cosortia, each of which will be able to carry data traffic and - in alliance with BT or Mercury - voice traffic as well. In the VANS segment the government has licensed over 600 VANS, but has stopped short of allowing 'simple re-sale' (ie, the sale of capacity on private circuits connected at both ends to public switched networks) until 1989. Liberalizing VANS involved the government in a regulatory nightmare, compounded by the haste and contradictory nature of its telecoms policy. The problem, in short, stemmed from conceptual confusion over the borderline between VANS and the basic telephone network, the sphere of 'basic conveyance', where the government had committed itself to a duopoly until 1989. Eventually, value-added services were defined in the negative, ie. to include everything that was not resale of voice and telex service. (DTI, 1986). However, in all three segments the process of liberalization has been qualified by the de facto market power of BT.

These new forms of competition, as qualified as they are, have made the UK telecom regime one of the most liberal in the world, certainly the most liberal in Europe. On its own this would have been sufficient to guarantee the UK an unique place in the European telecom scene. But, with the privatization of BT, the UK earned itself a doubly distinctive position by European standards.

There is a sense in which the privatization of BT - arguably the Thatcher government's most decisive act in the high-tech field, but absent from its 1979 manifesto - was inspired by factors other than telecommunications policy considerations. That is to say that two of the major attractions of privatizing BT were, first, to ease the burden of the recalcitrant PSBR and, second, to reduce the veto power of a powerful public sector union, the POEU. There were of course other factors, but to neglect these two 'external' factors would mean neglecting the distinctive nature of Thatcherism, which places an exceedingly high premium on controlling public expenditure and union power, both of which it sees as critical to the control of inflation. (Buiter and Miller, 1983).

The other factors behind the decision to privatize stemmed from the government's ideological belief that 'consumer choice and the disciplines of the market lead to more stable prices, improved efficiency and a higher quality of service'. More pressing was the fact that BT needed to borrow far more than in could, given the fact that such borrowing counted against the PSBR and the latter had to be subject to strict limits if inflation was to be reduced. Apart from the problem of external finance, the government argued that a publicly-owned BT had too

few incentives to increase its internal efficiency and, since 90% of its investment programme was 'customer-financed', this placed an unnecessary burden on users. Consequently, unless something was done 'radically to change the capital structure and ownership of BT and to provide a direct spur to efficiency, higher investment would mean still higher charges for the customer'. (DoI, 1982:1). For the government at least, privatization was part and parcel of the liberalization process, a view not shared by all corporate actors as we shall see.

Just as the DoI had little independent technical expertise to draw on in the breaking of the basic network monopoly, so it lacked its own resources to assess whether the sale of BT shares would be feasible. Afterall, the sale of 51% of BT shares, with an estimated value of `4 billion, would constitute the biggest stock market flotation anywhere in the world. A whole series of imponderables were thus involved. Could the UK equity market absorb such a sale?. If not, should it be sold in tranches?. Should it be offered overseas?. Given its de facto power, how and to what extent should a private BT be regulated?. Would the breaking up of BT, along the lines of the AT+T divestiture, not be more compatible with the declared aim of promoting competition?. Indeed, would the whole affair be popular?. These issues provoked intense debate within and beyond the DoI during 1981-82. Given the financial intricacies, and potential revenue effect, the Treasury played a far greater role here. However, the DoI, and indeed the government as a whole, felt dependent on the arcane financial expertise of the City, particularly on Kleinwort, Benson Ltd, financial advisors to the government and one of the underwriters of the issue.

The merchant banks who acted as underwriters of the issue played a large role in shaping the details of the sale. All too conscious of the fact that it had failed to dispose of all the shares of a previous sale (BNOC), and disturbed by the City's initially cool reaction to the proposed BT sale, the government felt that it had little option other than to place itself in expert hands. The government was informed, for example, that the City would not accept (ie underwrite) a situation in which a private BT was still in some way directly subject to government influence, as was the case in Japan, where the Ministry of Posts and Telecoms had regulatory responsibility for the privatized NTT. Again the City would be more 'comfortable' with government having a 49% rather than a 51% stake in BT. Although potentially embarrassing, the government was also persuaded by its underwriters to allow overseas interests to participate in the sale, so as to enhance the prospects for a successful issue. Overall their influence was both subtle and compelling. As one senior civil servant put it:

'The underwriters were seen as a source of legitimate expertise. Civil servants did not constitute an equal counterweight to them in a technical sense. If it flopped Kleinwort, Benson would be able to say 'we told you so'. Consequently, we had to keep the City warm throughout the privatization period'.

In view of the de facto power which BT would wield even after privatization, the government was implored (by its more liberal backbenchers, prospective competitors, BT's traditional suppliers and user groups like the TMA) to break up BT along the lines of AT+T. This would obviously have been the solution most compatible with the logic of liberalization, which was to promote competition. This option was considered in 1982 and, apparently, it was favoured by the Prime Minister at one point. (de Jonquieres and Freud, 1983). The 'break-up' option was abandoned for a number of reasons. BT lobbied furiously against the notion, deploying skillful arguments to the effect that this would make the company less able to compete with overseas IT giants; this in turn would devalue the attractions of the BT sale; and a broken BT would have less purchasing power to sustain indigenous suppliers. But just as important, if not more so, was the poor state of BT's internal accounting system. Without better accounts it was difficult to assess BT's constituent businesses. If BT was to be broken up it would have delayed the privatization process quite considerably. This became the decisive factor. The government was itself anxious to proceed as quickly as possible, although not before the 1983 election since it was sensitive to the charge that this project had not figured in its 1979 manifesto. BT too was anxious to proceed as fast as possible. Most of its senior management had been persuaded of the attractions of privatization and they agreed to co-operate with the government so long as BT remained intact and so long as the sale was accomplished in one tranche. In this way uncertainty within both the company and the market would be minimized.

Apart from the Labour Party and the trades unions, the principal opposition to privatization came from the domestic equipment manufacturers via their trade association, TEMA, and through Lord Weinstock, chairman of GEC, in the House of Lords. One of their major criticisms was that a private monopoly in all but name was being substituted for a public monopoly. They argued that a private BT would be more able to squeeze them, first as a competitor and, secondly, as their major domestic customer. They attacked the government for allowing BT to extend itself into new fields (like cellular mobile radio and cable TV). And they tried, unsuccessfully, to persuade the government to restrict BT's share of the subscriber equipment market to 25% and to veto any attempt by BT to move into direct production. (Weinstock, 1984). Symptomatic of the low esteem in which the equipment manufacturers were held by the government, they were never consulted during the privatization process. Indeed, there was a good deal of contempt for their performance. In the government's view their criticisms stemmed from a pernicious desire to preserve a cosy 'telecom club'. At one point GEC demanded the right to buy a stake in BT, but the DoI and BT's new chairman (George Jefferson) were both vehemently against allowing the 'dead hand' of GEC into BT.

The main trades union opposition to privatization was led by

BTUC, a federation of all six trade unions within BT. For the BTUC the major threats were to jobs, pay and conditions, socially desirable but uneconomic services and increasing charges for the residential customer.

Although the unions clearly failed to achieve their central aim - namely, defeating the 1984 Telecommunications Bill - they took comfort from the fact that they had forced the government to make a number of important amendments to the original Bill.(eg, greater protection for rural areas, services to the elderly and disadvantaged). The unions did not really believe that the government would actually proceed with privatization; they had received discreet noises from their contacts inside the DoI to this effect. When the reality dawned their bottom line was to prevent the break up of BT, a line on which they were at one with senior management in BT. All in all the unions felt that they had salvaged all that was possible under the circumstances. Far from being resigned to BT plc they now look to a prospective Labour government to re-nationalize BT. But, as yet, there is no common agreement among them as to the form or the terms of re-nationalization. (BTUC, 1984; POEU, 1984).

In November 1984 the largest ever single share issue anywhere in the world occurred: it raised £3.9 billion for the Treasury and the direct costs of the issue (ie. commissions to underwriters etc) amounted to some £323 million. Because the initial share price was undervalued - having increased by 33% in the first day of dealing - the government was severely censured by the all-party Public Accounts Committee. Taking this into consideration the Institute of Fiscal Studies calculated that the sale resulted in a net loss to the public of some `3.34 billion. By the time BT's first annual report was published BT's list of shareholders had shrunk from 2.3 million to under 1.7 million and, of these, the proportion of shares held by private investors was down to 13%. (Simpson 1985; Public Accounts Committee, 1985).

Since BT is now a private member of the UK telecommunications industry we examine its strategy, along with its implications, in the following section. Suffice it to say that Oftel, the new regulatory agency in telecommunications, has thus far had mixed success in policing BT and juggling with its own conflicting responsibilites. Its major success to date has been the imposition of 'inter-connection' terms which allow Mercury to link up to the BT network, terms which were highly favourable to the former. Yet, as we will see, it appeared to be powerless when it tried to limit BT's ordering of an alternative switching system. However, as mixed as its record may be, there is certainly no sense in which Oftel has been 'captured' by those whom it seeks to regulate. Overall the new telecom regime has fashioned a radically different configuration of 'winners' and 'losers' compared to the former regime, a subject we return to in our concluding section.

BREAKING THE 'TELECOM CLUB'

Governments often encounter enormous difficulties in exerting influence over private firms in so called 'free markets'. But it is commonly supposed that in markets where the government is itself the chief or even the sole customer its influence or power is much enhanced. Both here and in the following section this supposition forms one of our main exploratory themes. In this section, however, we are largely concerned with the inter-dependent relationship between the Post Office and its suppliers, the 'telecom club', and with government-industry relations in the aftermath of the club.

From the '20's through to the late '60's the relationship between the Post Office and its (private) suppliers was governed by Bulk Supply Agreements. Even though the Post Office was free, in principle, to supply its own requirements this freedom was never used other than for minor repair work. The rationale for the Agreements was that they facilitated standardization of equipment and eased the pooling of R+D between the PO and the five firms. The Agreements, each of which ran for five years, obliged the PO to purchase exclusively from the firms and the latter divided the orders between themselves. Oddly perhaps, not only did the more efficient firms not get a larger share of the orders but any economies, whether of technique or in production, accrued only to the firms. There was no great incentive to innovate and prices were often well above that which the PO could have obtained outside the 'Ring', as the suppliers were called. Although the PO was empowered to investigate its suppliers books so as to ascertain their costs, these cost investigations were too infrequent and often based on antiquated data. Here its task was not made easier by the costed firms who sometimes revised their costing systems, making it difficult if not impossible for the PO to gain a comparative picture. In the event of late deliveries the PO was allowed to claim 'liquidated damages', but this sanction was not triggered automatically. For example, none of the 41 major orders for exchange equipment that were due in 1968 was completed on schedule. Yet the PO refrained from seeking damages and granted extensions instead. This was partly because it had itself encountered problems and delays in deciding upon specifications, and also because the suppliers might then have quoted 'safe dates' which would have exacerbated the crisis of supply in the middle 1960's. As a result of mounting criticism from all sides the last of the Agreements, that for exchange equipment, was terminated by the Labour government in 1969. The PO had tried to terminate the Agreement on subscriber equipment long before it was due to expire, but the suppliers refused to forgo their rights under the Agreement.(House of Commons,1967; Public Accounts Committee, 1967; Comptroller and Auditor General,1968; POEU, 1962).

If the termination of the Bulk Supply Agreements ended the least defensible feature of the 'telecom club' it did not spell the end of the club itself. The latter survived up until BT was

privatized, although it was under considerable strain before then. Among the most problematical issues within the club three deserve a brief mention here: (1) the supply-side conundrum (2) technological choice and (3) the question of exports.

The Supply-Side Conundrum

Many of the problems which the PO faced in the 1960's and early 1970's stemmed from its failure to anticipate the surge in telephone demand in the early 1960's. This failure could largely be attributed to the PO's under-developed forecasting methods and under-investment in the past. But, even if the PO had anticipated the surge, it doubted whether it would have won approval for higher capital investment. So at that time the PO was obliged to work on a yearly basis as regards its capital programme. (House of Commons, 1967). For all the rhetoric of 'going for growth' in the 1960's the PMG was privately being told that the PO dare not advertise the service because of critical supply-side constraints. Exchange equipment presented the most serious problem of all because of the long lead times involved. Here matters were not helped by the fact that the suppliers had become highly sceptical about future forecasts from the PO, given the vicissitudes of its procurement policy.

But the core of the supply-side problem lay in a deep conflict of interests within the club. Under intense political pressure from the Labour government, itself apoplectic about burgeoning telephone waiting lists, the PO's interest lay in an immediate expansion of traditional (Strowger) exchange equipment. For their part the suppliers feared that as this equipment was fast becoming obsolete, they would be faced with excess capacity in the near future if they simply serviced the PO's immediate needs. The conundrum was succinctly expressed by the Brookings report, which said that the dilemma was 'further intensified because the PO believes that its exchange equipment design is so distinctive that it must be supplied from the traditional domestic firms, and thus would tie itself to suppliers who prefer to minimize overexpansion in just those lines it requires'. (Caves, 1968:404; Hills, 1984).

The PO had little room to manoeuvre: bound to its suppliers by the Bulk Supply Agreement until 1969 for most of its needs, it was unable to procure from outside the 'ring'. Significant too was the fact that the Director General of the PO was reluctant to consider any move into manufacturing, partly because he felt that civil service staff conditions would not allow the PO to be truly competitive with the private sector. Nevertheless, the PO was encouraged to actively consider this option as soon as it became a public corporation in 1969. (House of Commons, 1967). The PO's apparent inability to influence these supply-side constraints became a major factor in the decision to terminate the exchange Agreement which bound it to its suppliers. The Labour government, backed by the IRC, recommended that more competitive arrangements should be introduced after 1968 on both

design and supply. Later, PO engineers considered that this 'arm's length' relationship conflicted with the need for greater collaboration
in the transition to digital exchanges. (Harris, 1979; Hills, 1984).

Technological Choice

Just as many of the PO's problems stemmed from its failure to anticipate demand in the early '60's, other problems flowed from its excessively bold decision to leap direct from Strowger to fully electronic exchange equipment. This decision, fully endorsed by the private suppliers, was made in the late '40's, early '50's. The reasoning appears to have been that since the intermediate technology of Crossbar (more advanced than Strowger, but still electro-mechanical) was not immediately as economic as Strowger, then the most attractive option was to retain Strowger until fully electronic exchanges were installed. For the suppliers this option possessed great merit: they were geared-up to produce this mature equipment and the Commonwealth made for good export opportunities.

The apparent elegance of this scenario was shattered in 1962, when an experimental electronic exchange failed, proving that the PO's preferred solution would not be available for many years. Fearing such a result the PO had already begun to explore other alternatives - but, again, not Crossbar - and it decided in 1963 that the intermediate solution was to be the semi-electronic TXE series of exchanges. But within three years it was clear that even this semi-electronic system would not be ready in time to cope with the surge in demand then underway. Consequently, the pressure of events forced the PO to adopt Crossbar, the electro-mechanical exchange which it had consistently eschewed and in which it had little R+D experience. (Hills, 1975; Harlow, 1977; Hills, 1984).

Up until this time there was a great deal of unanimity between the PO and the firms over technological choice, facilitated by their Joint Electronic Research Committee, set up in 1956. But JERC was disbanded when the new 'arm's length' relationship was inaugurated in 1968. Over the next few years an unprecedented battle ensued as to which exchange system the PO should adopt for the medium term, or before a fully electronic system became available. Should it be Crossbar, sponsored by Plessey and GEC, or the TXE semi-electronic series, supported by STC and to which the PO was favourably disposed?. We shall examine this issue in the following section. Here we simply note that one of the burning questions was the exportability of the respective systems.

Responsibility For Exports

Rightly or wrongly the Post Office acquired a reputation for producing specifications which were insensitive to both cost and export considerations, with the result that technical excellence rendered products unsaleable abroad. This, in turn, is said to reflect its long-standing belief that its network needs are idiosyncratic and so not readily comparable with those overseas. (STC, 1976). Indeed one supplier even complained that 'we could export not one single product that emanated from the laboratories of the British Post Office'. (Clark, 1985). The question of export responsibility forced itself to the fore as the suppliers' export record deteriorated from the middle 1960's onwards.

For its part the PO felt that it had a right as well as a duty to minimise the 'whole-life costs' of its equipment and therefore it always tried to optimise its specifications. When pushed on these issues the PO understandably sought sanctuary in its statutory duties. The 1969 Act, for example, obliged the PO to 'meet the social, industrial and commercial needs of the British Islands'. Some suppliers considered that this could be interpreted so as to include an export responsibility. However, the PO interpretation was that since it contained no explicit export duty, the PO's overriding priority, indeed duty, was to the UK network. However, it claimed that over and above this primary duty it was willing and able to assist the export effort. But, at bottom, it felt that the private firms did not possess the knowledge of overseas markets in the way that Ericsson did, for example, because they had too little overseas expertise. The PO was confirmed in this view when the Conservative government persuaded both parties to create a joint export committee. The PO claimed that the result was farcical: the firms refused to discuss export opportunities with the PO in the presence of another (competitor) firm. But even in bi-lateral discussions the PO re-affirmed its view that none of its suppliers had an adequate knowledge of export markets. Some confirmation of this view comes from within the firms themselves. A marketing manager at STC conceded that 'when Post Office demand was high we didn't want to know about export'. (Young, 1983). Plessey and GEC both felt there was too little incentive to export: they would have had to accept lower profit margins in export markets and they were more concerned with earnings per share.
What emerges is that both parties within the 'telecom club' thought the other was to blame for poor export performance. Here, the major responsibility fell on central government because of the terms of reference which it had imposed on the PO, allowing both parties in the club to find some ammunition in the ambiguities of the Act.

These problems - of supply, technology choice and exports - did nothing to promote harmony between the PO and its suppliers or, indeed, among the suppliers themselves. Inter-firm corporate rivalry visibly increased in the 1970's partly because STC succeeded in winning the lion's share of PO exchange orders over

GEC and Plessey. As we show in the following section, such inter-corporate rivalry was to dog the System X programme and this, combined with a growing need for rationalization of supply, induced a number of attempts to restructure the industry, sponsored by the PO, the DoI and the NEB. These all came to nothing. They foundered on the fact that neither the PO nor the DoI was prepared to challenge the sovereignty of the private firm. The latter, it seemed, possessed an inalienable 'right' to a share of the PO investment programme. It is for this reason that we can speak of the persistence of the 'telecom club' long after the termination of the Bulk Supply Agreements. It was precisely this fact which caused one senior PO manager to declare, ruefully, that 'the Post Office was unable to do what it wanted in its own house'. In some ways it may have been true that the PO possessed 'exceptional strength in contractor-customer relationships'. (STC, 1976). But such a view needs to be heavily qualified. The PO had no production facilities of its own, hence it was wholly dependent upon its traditional suppliers. And governments, as we show later, would not allow the PO to disengage itself from these suppliers. We have here a perfect illustration of the reciprocal nature of power relations. (Giddens,1979).

The traditional telecom club could not long survive the twin challenges of liberalization and privatization: the first exposed BT to competition, the second allowed BT to persue an aggressive commercial strategy. As a result BT claimed that it could no longer 'afford to adopt a benign or paternalistic approach which would restrict purchasing to UK sources irrespective of the consequences to its competitive position'. (Lex, 1985). Among the chief merits of privatization so far as BT was concerned, not the least was the opportunity to exercise its hitherto untapped power vis-a-vis its traditional suppliers. The most significant examples of this new found aggression being: (1) the rationalization of the System X programme, which we examine in detail in the following section (2) the introduction of Thorn-Ericsson as an alternative 'foreign' supplier of digital public exchanges and (3) the acquisition of a majority stake in Mitel, a leading North American supplier of advanced private telephone exchanges (PABX's). That each of these moves was politically contentious indicates that BT's autonomy is perhaps more limited than the conditions of its main license might suggest. However, BT's last two moves are also significant as a comment on the contradictory character of public policy. In view of the Thatcher government's declared aim of promoting competition, it is worth noting that the introduction of Thorn-Ericsson and the acquisition of Mitel produced very different effects. Indeed, since these two decisions encapsulated many of the new trade-offs that have to be made under the current UK telecom regime, each deserves to be examined.

(1) The Entry of Thorn-Ericsson: BT had been actively considering an alternative to its System X exchange long before privatization, having conveyed this 'bombshell' to its traditional UK suppliers as early as 1982. BT would have initiated a selection process sooner but, due to the impending 1983 election and because BT was yet to be privatized, the DoI

´invited´ BT to suspend this provocative decision until after the election. BT had two main reasons for wanting a new supplier; firstly, it needed security of delivery and, secondly, it wanted to harness a second supplier as a ´pacing horse´ to impose more competitive pressure on Plessey and GEC so as to get a better deal on the price, quality and delivery dates for System X exchanges. In other words, the decision was a signal to the UK firms that they were not going to be able to exploit or undermine BT´s huge ordering programme for System X. To this end BT invited tenders from eight alternative suppliers at the end of 1984, from which it short-listed three: AT+T/Philips, Northern Telecom and Thorn-Ericsson. The short-list was itself contentious because of the absence of an EEC candidate. The French, in particular, were deeply aggrieved, having made great efforts to get BT to agree to a reciprocal opening of public markets in the EEC. However, BT rejected the French tender because it felt that the French exchange (the E10) was technically inferior to those of the short-listed firms and because the BT chairman refused to ally BT with the Alcatel chief (George Pebereau) as a result of past conflicts. In the event BT selected Thorn-Ericsson for a number of reasons. It offered the best financial package; it promised the quickest delivery date; and, although it was based on Swedish technology, it was 51% UK owned with an existing factory in Scunthorpe and an Ericsson-owned software development company in Brighton. Also significant was the fact that Thorn-Ericsson´s chairman, Sir William Barlow, was a former chairman of the Post Office and well connected with the BT Board, and he was uniquely able to brief the firm on BT´s requirements.

BT´s decision to go ´foreign´ provoked a storm of protest from the traditional suppliers, their unions and from an all-party group of MP´s: these argued that this would reduce the home market for System X, jeopardise exports and reduce UK employment. As a result they appealed to Oftel to over-rule the decision.

The proposed entry of Thorn-Ericsson was an important test-case of how Oftel would juggle with its conflicting obligations. However, Oftel was in no doubt as to where its priorities lay. Since BT had rationalized its decision in terms of promoting competition in the interests of final consumers, the Director General announced that if he opposed BT´s decision he would run foul of the ´primary rationale of the regulatory regime in telecommunications´. (Oftel, 1985). Consequently, he endorsed the decision since ´BT is acting with normal commercial prudence´. But, aware of his secondary responsibilities to the UK industry, he was worried that a too rapid shift towards System Y (as Ericsson´s AXE exchange is called in the UK) might give Plessey and GEC too little time to adjust to their new competitive environment. Afterall, the ´purpose of introducing competiton is to strengthen them - not to damage them´. In addition to this question of adjustment, he expressed a good deal of sympathy for the fact that the UK had opened its market without gaining reciprocal access in overseas markets, a point emphasized by the forlorn UK suppliers. In view of these two factors he recommended that BT should not purchase more than 20% of its exchange needs from Thorn-Ericsson for three years from

1987. However, BT lost no time in rejecting this limitation on its freedom of action. This swift rebuttal underlined the fact that Oftel's recommendations are not enforceable. The main course of action open to Oftel, had it felt sufficiently determined, would have been to amend BT's license. This, however, would have been a severe and embarrassing blow to the government: the tightening of the license so soon after privatization may have been seen as the government reneging on its commitments to BT's new shareholders.

Three further points are worth making about the Oftel inquiry. Firstly, Oftel made it clear that its duties did not require it to attach any great significance to the employment dimension. Even so, it judged that the net effect on jobs would not be much affected whichever path was chosen because losses at GEC and Plessey would be offset by new jobs at Thorn-Ericsson. Secondly, Oftel expressed concern about the viability of the UK telecom industry in the longer run because 'market forces, if allowed completely free play, may bring about a situation in which technological skills are not maintained in the UK'. In other words, the diversion of orders to Thorn-Ericsson reduced the market out of which the UK firms had to fund future R+D costs. To alleviate this problem Oftel floated the idea of creating a UK research organization, with the aim of maintaining a competence in modern switching technology. But here it was forced to acknowledge that a private BT may have little interest in committing itself to longer term research. Since this issue raises important industrial policy considerations we shall return to it later. Finally, in attacking BT for going 'foreign' the UK lobby did not seem to be aware of the foreign content in the 'British' System X exchange. By 1988 some 70% of the value of System Y would be manufactured in the UK, which is the same for System X, since Plessey and GEC obtain some of their most sophisticated items (like integrated circuits) from the US and Japan. In conclusion we can see that the overall effect of Thorn-Ericsson's entry was to enhance competition in the UK switching sector, a result which is perfectly compatible with the government's declared policy.

(2) The Mitel Affair: this was an important acid test of the government's commitment to a competitive market. Mitel was a Canadian supplier of private telephone exchanges (PABX's) with wholly-owned subsidiaries in ten countries, including the UK. A period of phenomenal growth enabled Mitel to capture some 10% of world-wide PABX sales. By 1984, however, it began recording heavy financial losses, as a result of increasingly severe competition coupled with its own development problems. As a result it began the search for alliances and, in 1985, a tentative agreement was reached between BT and Mitel. Widespread concern from both competitors and users resulted in the proposed merger being referred to the Monopolies and Mergers Commission. The fears of the traditional UK suppliers was understandable. Four companies - GEC, Plessey, TMC and Mitel - accounted for 82% of all PABX deliveries in 1984. However, the three UK companies were more dependent on distributing their products through BT than was Mitel: in 1984, for example, BT accounted for 81% of the combined sales from GEC, Plessey and

TMC. The UK suppliers' dependence on BT went deeper than this, since 50% of their sales to BT consisted of BT proprietary products, ie developed by BT and manufactured under license. On top of this BT had recently increased its authority in the PABX market, having pushed up its share of distribution from 65% of the total value in 1981 to 74% in 1984. Equally disturbing to the UK suppliers was the fact that BT had begun to address the large PABX segment, a market in which it had no presence until 1983. A further dimension of BT's dominance was its practice of insisting upon exclusive distribution rights and intellectual property rights, both of which were used to suppress competition. All in all BT had become extremely aggressive in this market: it had consciously stalled the liberalization process so as to 'churn' the PABX market in its own favour. In this context BT's proposed acquisition of Mitel struck alarm in each of the UK firms because Mitel was already dependent on BT for 72% of its total UK deliveries, and they feared that they would lose out if this proportion grew in the future. The merger also alarmed the independent distributors because Mitel supplied 50% of their total requirements in 1984 and, since the BT/Mitel accord, their relations with the latter had deteriorated.

BT portrayed the merger as vital to its ambitions in international IT markets, down-playing the domestic implications. The chief benefits of the merger for BT were said to be (1) synergy between R+D and manufacturing (2) a presence in overseas PABX markets and (3) fusion of complementary skills to exploit the rapid convergence of telecoms and computing. Playing on the government's achilles heel, BT added that it would be neglecting the interests of its shareholders if it did not diversify in the face of growing competition.

The proposed merger provoked a good deal of division within the regulatory authorities. The MMC was itself split, with the majority in favour of the merger providing stringent measures were enforced, like a three year ban on BT's sales of Mitel equipment in the UK. It was led to this conclusion because it had found that the merger was 'likely to operate seriously to reduce the growth of competition in the market with adverse effects on telecommunication users who may expect reduced choice and higher prices'. (MMC, 1986:73). For its part Oftel wanted the MMC to consider a modification of BT's licence to ensure the efficacy of any new safeguards. In the event the DTI diluted the MMC's safeguards and ignored Oftel's worries: it approved the merger on certain conditions, like a ceiling on BT's sales of Mitel products in the UK. Within the DTI competition was not the decisive issue for, as one official conceded:

'there was enormous political pressure on us to allow it to go through from those wishing to see BT establish itself in the US. But, more important, was the pressure from the Welsh Office: the Welsh Secretary went to the PM and simply said that Mitel would close its plant in Wales if the deal did not go through. That clinched it.'

Some critics saw the Mitel affair as evidence of the weakness of the UK's regulatory regime and its weak commitment to

pro-competitive practices.(Gist and Meadowcroft,1986). It would be nearer the truth to see it as a comment on the contradictory character of public policy, with the government torn between liberalization on the one hand and covert industrial and regional policies on the other.

The Mitel and Thorn-Ericsson deals may have been the most dramatic of BT´s moves to date, but they are only two examples of BT´s frenetic attempt to create a career for itself as a broader based IT company. Among its other significant moves in this direction one might cite BT´s joint-venture with McDonnell Douglas in the field of electronic information systems; its joint-venture with Du Pont to mass produce advanced opto-electronic components; its purchase of IAL from STC, which specialises in aviation communications; and its acquisition of Dialcom, the US electronic mail company. In addition to these moves BT has sought to head off future competition to its PSTN in the UK through heavy involvement in cellular radio and Cable TV consortia.

To complement these external ventures BT is in the process of implementing a radical internal reorganization: BT is now divided into five divisions with de-centralized management. Ironically, BT was something of a cobblers´ child until recently, in that it made little use of advanced technology for monitoring its own internal operations. To remedy this problem BT has launched a £200m programme to computerize its customer service operations, due to be completed by 1990. (This marked another shift in BT´s procurement policy because BT passed over ICL, on whom it traditionally relied, and awarded the bulk of its orders to IBM). Furthermore, since BT believes itself to be ´job-heavy´ by international standards, it is actively trying to shed labour: some 20,000 employees were displaced in the four years to 1986, and BT hopes to shed a further 24,000 jobs during the next four years. In an attempt to become ´leaner and fitter´ BT has unleashed an offensive against organized labour within its ranks: its aims being to de-unionize middle management, to extract more flexible working practices from all grades, to increase differentials between grades and to de-centralize collective bargaining. In short, BT has moved from a paternalistic to a ´macho´ style of management in this sphere. (POEU, 1984; Goodhart, 1984).

Yet for all its grand ambitions to become a broad-based IT company, BT´s traditional role as a telephone network operator continues to dwarf all its other activities: the PSTN accounts for 60% of BT´s turnover, 80% of its total assets and some 67% of its pre-tax profits. (de Zoete and Bevan, 1984). Despite BT´s colossal size advantage over its new competitor, Mercury, BT was desperately worried by the threat of competition because its revenue base was so precariously narrow. For instance, around 75% of BT´s trunk revenues are generated by business users. Indeed, BT´s largest 300 business customers alone generate around 20% of its trunk revenues even though they account for less than 1% of all BT´s business installations. This narrow revenue base illustrates two things: (1) the extent to which BT is vulnerable to a competitor which has specifically targeted

the lucrative large business user sector and (2) the enormous power which a numerically small group of corporate users has over BT, especially when one considers that BT serves some 20 million customers in all.(Financial Times, 1984). Since business users are more profitable than residential users, and since lucrative trunk and international calls were used to subsidize local call charges, BT has thrown itself into re-balancing its tariff structure. The broad thrust has been to increase charges for uneconomic or loss-making activities - like residential services - whilst reducing charges in the lucrative segments - like international calls - where BT expects to face growing competition from Mercury.

Such re-balancing is proving to be politically contentious, especially among residential users, who feel that they are losing out to large business users. Although BT insists that local charges have been increased because they were previously 'uneconomic', the TUA argues that there is no convincing evidence for this claim. Significantly, some of BT's largest increases have been in the sphere where it enjoys a monopoly, eg. local calls. Under its license BT is obliged to limit a weighted average of price changes to three percentage points below the rate of inflation, the RPI-3 formula. Although Oftel found that BT's re-balancing had complied with this formula, it also registered 'a sense of outrage because BT was already making profits that complainants regarded as extremely high'. (Oftel, 1986). Indeed, Oftel itself agreed that BT's rate of return exceeded the minimum acceptable level in a competitive market, but chose not to intervene so soon after BT's shares had been sold under the existing license!.

As a result of BT's re-balancing, local charges in the UK are now among the highest in the OECD, while international call charges are among the cheapest. BT's policy of lowering its international tariffs has another motive besides that of pre-empting competition from Mercury. It is also driven by the aim of making the UK the major transatlantic hub for telecom traffic between the US and Western Europe. BT sets an extremely high premium on trying to induce multinationals in Europe to either base their telecom activities in the UK or else to route their transatlantic traffic through London. So aggressively has BT pursued this policy that it has succeeded in 'stealing' traffic away from its counterparts in Western Europe. So much so that a third of all multinationals in Western Europe now route their traffic through London and the UK accounts for nearly 50% of the transatlantic telephone market. (Bruce et al, 1986). This policy of attracting advanced telecom users to the UK is also a high priority for the government. Such is the significance attached to this goal that it was elevated into one of Oftel's responsibilities under the 1984 Telecommunications Act. This aggressive drive to establish the UK as a transatlantic hub has two important consequences: (1) it reduces the scope for co-operation among European network operators and (2) it makes BT more sensitive to the demands of multinational users than are its European counterparts.

Overall, BT can be well satisfied with its own position. Although it faces newly established network competition from

Mercury, the latter should not be conceived simply as a threat. If anything BT has used the existence of Mercury as an ideological resource: the fact of competition is invoked to bolster its demands for diversification and to strengthen its hand in its negotiations with suppliers and unions alike. In the absence of a Mercury BT would inevitably have a much higher political profile and, as a monopoly, it would be subject to far more stringent controls on its freedom of action. As to the other side of the coin, it is still too early to assess what negative effects Mercury will have on BT's position. With very few exceptions - such as its failure to forge a joint-venture with IBM and its inability to prevent Mercury from winning favourable inter-connection terms - BT has thus far won all its regulatory battles. As a result, its power in the UK market has been much enhanced by the twin processes of liberalization and privatization.

However, the same cannot be said of the traditional UK suppliers. For Plessey, GEC and STC the new rules of the game contain a strong zero sum element; they feel that BT's gains have been their losses. Although all three are diversified companies, telecoms accounts for a sizeable part of their total activities. Of the two major suppliers, Plessey and GEC, the relative importance of telecoms is decidedly different. For instance, in 1984/5 Plessey's telecom division accounted for £677.3m out of a total turnover of £1.4 billion and contributed £74.6m to an overall operating profit of £143.3m. GEC's dependence is less: its telecom division accounted for £455m of a total turnover of £5.2 billion and this contributed £62.9m to an overall operating profit of £528.9m. These two firms together had £625m of BT's business in 1984/5, which represented a third of the value of BT's total procurement budget for that year. However, the composition of BT's purchasing policy is changing as BT tries to transform itself from a pure network operator into an internationally competitive IT company. As a result BT is now buying more from the IT 'community', especially from the likes of IBM and Hewlett-Packard. In addition, it has diversified its supplier base from some 2,000 in the days of the Post Office to around 6,500 now. This augurs ill for the traditional top suppliers: in fact the share of the top four suppliers has fallen from 70% to 50% in the decade to 1986. Moreover, the proportion of non-competitive procurement has fallen from some 60% to 40% over the same period.

Quite apart from this threat the traditional UK firms are not well positioned to thrive in a telecom market which is becoming more and more internationalized. In BT's view the weakness of the UK firms stems from the fact that their volumes are low; their R+D teams are dispersed; export performance is poor; and too little is being devoted to R+D. The R+D index provides an instructive comparison: in 1984 AT+T spent some $2.4 billion on R+D, Ericsson spent £215m and Northern Telecom committed some £330m. In contrast, Plessey and GEC's combined R+D spending in telecoms in 1985 amounted to less than £150m, of which £40m comprised System X enhancements financed by BT. Significantly, the only index which shows GEC and Plessey in the international top ten suppliers of electronic capital equipment is that of operating profit as a percentage of sales. (MMC, 1986b). Each

company feels that this is the all important index, even though it leads to short-term investment horizons compared to overseas competitors. Having resigned because of this philosophy, one former manager felt that it was not enough to indict only the companies because: 'the City placed such a huge premium on short-term profits. If one did not submit to this philosophy then the City would force your share-price down'.

Faced with an increasingly hostile climate at home and abroad the leading UK telecom firms are having to re-align their strategies. Plessey appears to have been the first to anticipate this less hospitable climate and, in 1982, it acquired Stromberg-Carlson, a US telecom manufacturer. The main thrust of Plessey's strategy in recent years has been to penetrate the US public switching market; but fierce competition in the US has forced it to adopt a niche strategy by selling, not System X, but a smaller exchange developed by Stromberg-Carlson. Within Europe Plessey views the future in terms of collaborative deals, like its quadripartite agreement with Alcatel, Siemens and Italtel, which includes pre-competitive development of broadband networks. Since being dropped from the System X programme in 1982, STC is trying to become a broad-based supplier of information systems which straddle computing, defence and telecom transmission sectors. To this end it acquired ICL, the UK's major computer company. But, unable to retain the 'confidence' of the City, STC has been grappling with less grandiose issues since 1985, namely, asset sales, cost control and redundancy programmes, all designed to restore 'confidence' in its share price. For its part GEC appears to have been the least adventurous. Apart from acquiring the US office equipment company, AB Dick, GEC had to lobby hard to stay in the System X programme and, compared to Plessey, it has tended to rely more on licensing (from Northern Telecom and NEC in the PABX field) to meet the threat of liberalization. Since 1983 much of GEC's energy in the telecom sector has been devoted to trying to get Plessey to agree to some form of telecom merger. With no prospect of an agreement in sight GEC decided to force the issue; in December 1985 it launched a takeover bid for Plessey, signalling one of the most important corporate battles in the recent history of the UK electronics sector.

The GEC-Plessey Merger Debate: this takeover battle was by no means a pure telecom affair, a factor which ultimately proved to be decisive. Between them GEC and Plessey account for 25-30% of the entire UK output of electronic capital equipment. As well as being the leading UK suppliers in the telecom and defence sectors, they are also two of the major UK suppliers of electronic components. Nevertheless, GEC's challenge was originally prompted by its urge to rationalize the joint System X activities, even though combined sales accounted for a mere 5% of the aggregated total turnover of the two companies. However, in its actual bid GEC emphasized the attractions of merging the entire operations of each company so as to capture the synergies between componentry and systems and also to reduce duplication of resources. But its core argument revolved around the claim that the merger would provide the economies of scale which would

allow the new group to 'fight off foreign competitors at home and abroad'. (GEC, 1985b). GEC felt that it had been encouraged to make its bid by positive soundings from the DTI; the previous year a junior trade minister (Lord Lucas) had publicly spoken about the logic of such a merger. Furthermore, GEC knew that BT was well-disposed to a futher rationalization of System X production. It all seemed to add up to a propitious context - at least in the telecom sector.

In response Plessey tapped some resonant themes in its critique of GEC's challenge. It disputed the claim that corporate size was the critical factor for success in exploiting R+D; it documented GEC's record of contract delays and cost-overruns; and it spared no effort in criticising GEC's managerial philosophy of short-term economies and cash accumulation which, it claimed, 'is fundamentally unsuited to running a high technology business'. (Plessey, 1986). Although Plessey conceded that System X production needed to be rationalized under a single supplier, it argued that this did not merit a total merger of both companies. Its key argument was that a total merger would create massive market dominance, especially in the UK defence sector. Here Plessey was knocking on an open door so far as the Ministry of Defence was concerned. In recent years the MoD had been moving towards a more competitive procurement policy to obtain better value for money. GEC and Plessey were already major contractors: in 1984/5 they accounted for 23% of the MoD's £7.8 billion equipment budget. For its part the MoD was horrified at the potential lobbying power of a combined company. Therefore it strenuously opposed the merger because the 'certain loss of competition would be more harmful than the speculative gains from larger size'. (MMC, 1986b:66).

Significantly, the DTI case in favour of the merger was put, not by the Secretary of State, but by the those parts of the DTI which had sponsorship responsibilities for the UK telecom and electronics sectors. As the Secretary of State had the 'final say' on the MMC verdict, it was thought inappropriate for him to combine the roles of witness and judge. What is striking about the respective roles of the MoD and the DTI is that the former forcefully opposed the merger, while the latter spoke only of 'possible benefits'. These differences were to some extent inherent in the situation because the benefits of a merger were contingent on a whole series of imponderables. But the fact that the DTI lobby was deprived of someone with Cabinet status did not help its case either. Furthermore, the DTI was anxious not to cross swords with the MoD so soon after their bloody public battle over the Westland crisis.

The forces arraigned against a full merger were considerable. Oftel thought that the only justification for a merger was in the sphere of System X production and that the rest of the structure should remain unchanged. Moreover, since Plessey had warned of the threat to direct and indirect employment, the majority of the unions also came out against the GEC bid. In the event the MMC judged that the merger could be expected to 'operate against the public interest' and that its only justification was to rationalize System X production. With one dissenting voice it had been unable to establish a direct link

in the electronics sector between company size and competitive performance. However, the dissenting voice felt that the merger could 'strengthen competition if it is seen in an international context'. Overall it seems that the national context was the main arena in which the net effects were assessed; a reverse situation to the US, where anti-trust regulations are being relaxed to allow US firms to become stronger international actors. Above all else, however, the outcome was one more reminder of the increasingly powerful role which the MoD plays not just in military technology, but in the UK electronics industry more generally. (Morgan and Sayer, 1987).

If the merger proposal accentuated the intense corporate rivalry between GEC and Plessey, it should not obscure the shared sense of outrage which they and others have felt at the 'cold shower' policies of the Thatcher government. Being heavily dependent on public contracts, especially in defence and telecoms, political relations were bound to be somewhat fraught with a pro-liberal government bent on breaking up cosy cost-plus contracts in the name of economy. The fact that GEC and Plessey are among the major financial donors to the Conservative Party is sometimes construed as evidence of a strong affinity between the interests of the former and the policies of the Thatcher government: in other words, 'those who paid were those who gained'. (Ross, 1983). Crude determinism of this kind fails to capture the fact that significant ruptures have opened up between the likes of GEC and Plessey and 'their' government, each side displaying a barely disguised contempt for the other. It is not good enough to say that these are merely 'tactical' differences between two sides who are in common cause on 'fundamentals'. Such a view, though partially true, is grossly inadequate. Quite apart from the difficulty of establishing when the 'tactical' merges into the 'fundamental', this interpretation devalues the stakes involved in 'tactical' battles and leaves little room for inadvertent effects or for misconceived action.

Nothing better illustrates the growing dislocation between the Thatcher government and the major (UK) telecom firms than the unconventional political tactics which Lord Weinstock of GEC has been obliged to adopt. Over the course of the Thatcher period relations between GEC and Downing Street have been totally transformed, from mutual admiration to public hostility. GEC's status as the UK's largest manufacturer, and its role as chief 'sub-contractor' to the state, has given it unrivalled access to the corridors of political power in both Whitehall and Westminster. Not content with this structural power, because it produces unreliable results, GEC has always tried to equip itself with the best political antennae. For example, its current chairman is an ex-Cabinet minister, as was his predecessor, and a former governor of the Bank of England is included among the directors of the company. GEC's lobbying power has been formidable, not least because there are no less than 127 MP's with a constituency interest in GEC. In the past, however, Lord Weinstock's own lobbying has been through private pressure, frequently at prime ministerial level, rather than through public protest. Perhaps the best index of GEC's novel plight was the unprecedented sight of Weinstock publicly censuring the government in the House of Lords for what he had

earlier failed to secure through private discussions in Whitehall. (Weinstock, 1984; Riddell, 1984).

The immediate cause of 'disquiet and concern in the industry', as Weinstock put it, was the 1984 Telecommunications Bill, which paved the way for BT to be privatized. As we saw earlier, Weinstock felt that a private BT could more easily supplant its traditional suppliers. And, since the latter would also be competitors to BT, he argued that the suppliers 'cannot be too aggressive in the market for fear of annoying an all-powerful patron'. (Weinstock, 1984). Weinstock has also assumed the role of public critic on wider aspects of government policy, namely, on inward investment and over the low priority accorded to UK manufacturing industry. (Weinstock, 1985). However, the telecom sector presents a microcosm of the conflicts engendered by the government's 'cold shower' policies in general and by its commitment to inward investment in particular. As the self-appointed voice of indigenous industry, Lord Weinstock has led the attack against using subsidies to induce 'foreign outposts' to locate in the UK because, he argues, they do not introduce base technologies, they exacerbate the skills crisis and they displace indigenous employment. All in all GEC sees its home base threatened by inward investment on the one hand and by BT's more competitive procurement policy on the other. Summing up GEC's attitude, its chairman was driven to the conclusion that 'it is impossible to imagine any of our foreign competitors being so disadvantaged by their own people'. (GEC, 1985a).

On top of all this the decision to cancel GEC's Nimrod contract with the MoD in favour of a US system from Boeing, after Nimrod had incurred sunk costs of nearly `1 billion, is only the latest ignominy which GEC has suffered at the hands of the Thatcher government. Indeed, at no time in its history has GEC's voice carried so little weight and respect in government circles as now. So much so that these 'tactical' defeats have affected GEC's 'fundamental' interests, by contributing to a climate in which some £1.5 billion was wiped off GEC's stock market value in the second half of 1986.

The power of firms like GEC and Plessey stems in large part from their near monopoly role as 'sub-contractors' to the state. In captive markets, like that of telecoms before 1982, or under 'patriotic' industrial policies, like those dear to the Labour Party, this power is all the greater. What concerned the Thatcher government was not that these firms had too much power per se but, rather, that they had so little to show for it in terms of innovation and exports etc. What is more, this pro-liberal government could rightly argue that the corporatist policies of its predecessors had been manifestly unable to remedy the situation, not least because they placed too few demands on the firms. The poverty of past policies reinforced the government's ideological inclination to substitute market forces for political forces because, of the two, the former appeared to carry a greater and more credible threat to state-dependent firms. With some justification the government can claim that nothing has concentrated the minds of GEC and Plessey quite so much as the entry of Thorn-Ericsson.

The indigenous telecom firms do not fully appreciate the significance which the Thatcher government attaches to luring foreign capital into the UK. They tend to concentrate their criticism of inward investment on the displacement effect on jobs in the indigenous sector. However, if job creation was the major rationale behind the inward investment policies of previous governments, it is not so for the Thatcher government. The latter is fully prepared to accept that inward investment displaces both jobs and market share from within the indigenous sector, because it believes that these drawbacks are offset by the more advanced managerial and technical practices which foreign firms bring to the UK. In short, the Thatcher government perceives foreign firms, especially those from Japan and the US, as fulfilling the role of 'tutor' to both management and labour in the UK. (DTI, 1983; Morgan and Sayer, 1987). This leads to the familiar refrain that this government is not sufficiently 'patriotic' towards indigenous industry in the UK. The pro-liberal riposte is that the 'patriotic' industrial policies of the past were not in the long term interests of British capital. Such policies, it is argued, only served to cosset indigenous industry and deprived it of the most vital stimulation of all, namely, exposure to best practice international competition. The charge that the Thatcher government is less 'patriotic' by the conventional standards of the past contains some truth because, in the pro-liberal scenario, what matters is not so much the nationality of capital, but its competitive capability. No government has gone so far in devaluing the claims of indigenous British firms. In other words the Thatcher government makes little or no distinction between British-owned and British-based firms from overseas, other than to cite the latter as exemplars of what it would like the former to achieve. One small, but significant, example here would be the elevation of an IBM executive to the position of chief scientific advisor to the government.

The worry for the indigenous telecom firms is that their industry may suffer the same fate as the 'British' consumer electronics and semiconductor industries, both of which have been overwhelmed by British-based subsidiaries of powerful US and Japanese firms. Even before liberalization there were disturbing signs of attrition in the indigenous UK telecom industry. The fact that the UK has now opened its market without gaining reciprocal access to overseas markets was one of the most worrying issues to Oftel when it had to consider the entry of Thorn-Ericsson. As a result the UK telecom firms are now the among the least sheltered in Western Europe and the UK has become the major deficit country in the EEC in terms of its external trade balance in telecoms. (ERA, 1985). This deficit betokens a growing divergence between the sophisticated demands of UK telecom users and the rather pedestrian supply side performance of the indigenous telecom industry. Equally disturbing, the influx of foreign investment in the UK telecom sector appears to have done little to arrest the UK's deteriorating trade balance. It is significant that the UK has been selected as the major European base for US and Japanese telecom firms, like AT+T, Northern Telecom, Rolm and NEC. Among the reasons why they chose to locate in the UK are: (1) that the

UK is the most liberal market in Europe and (2) they feel it is easier to displace indigenous firms in the UK than it is in France and the FRG, where the level of 'industrial patriotism' is much higher. As we have seen, this is precisely what infuriates the likes of GEC and Plessey, who claim to be seeking not protectionism, but equity.

Publicly, the DTI adopts a position of equanimity over the plight of the traditional suppliers. It deflects criticism of its 'cold shower' policies by arguing that the UK telecom industry should not be equated with traditional suppliers like GEC, Plessey and STC. It points to the new breed of firms that are emerging as suppliers to BT. However, BT itself admits that these are small niche firms which cannot hope to fill the space vacated by the traditional suppliers. If anything the main heirs apparent are not small indigenous suppliers, but firms like IBM, Thorn-Ericsson and Hewlett-Packard. Faced with chillier signals from its sponsor, the DTI, the indigenous equipment industry looks to NEDO to publicise its plight. Perversely, the UK firms take some comfort from NEDO's dire warnings to the effect that, on present policies, the UK will not have an independent broad-based IT industry by the end of the decade.(IT-EDC, 1984). As we saw earlier, Oftel too appears to be worried by the attrition of an indigenous capability in the telecom sector.

The Thatcher government remains unimpressed by the chorus of criticism from the indigenous firms because, in its view, the 'indigenous' sector embraces British-based firms as well. Using this definition it tries to portray such criticism as both alarmist and defeatist. Summing up the changes which it has wrought in the telecom sector we might say that, with the major exception of BT, it has overridden traditional producer interests in the name of greater 'consumer freedom', which, for the most part, is a euphemism for business users. In contrast to its counterparts in France and the FRG, for example, the Thatcher government has allowed large business users to dictate the pace and direction of change in the UK telecom market, irrespective of the UK's indigenous supply capabilities. Whatever the benefits on the business user side, the costs lie in a deteriorating trade balance, greater dependence upon foreign supply and a domestic industry which is exposed to liberalization at home, without reciprocal access abroad. It is one thing to liberalise a telecom market in which indigenous producers are strong, as in the US, but it is quite another to do so in a market, like the UK, where domestic producers are already relatively weak. It would seem that the neo-liberal strategy contains some heroic assumptions about the recuperative powers of the British-owned telecom industry.

THE POLITICS OF TECHNOLOGICAL CHANGE: THE CASE OF PUBLIC SWITCHING

Public switching equipment (ie telephone exchanges) is the largest single item of capital investment in the telecommunications network, accounting for well over a third of BT´s total fixed assets. Traditionally, the long lead times involved in designing and manufacturing switching systems was seen as a major rationale for the quasi-symbiotic relationship between the Post Office and its suppliers. Working together in the JERC forum the two sides had been in broad agreement with respect to the evolution of switching systems. But, as we saw earlier, JERC was disbanded in 1968 in favour of a so-called ´arm´s length´ relationship and, within two years, the united front on switching had been shattered. This experience played a crucial part in retarding the development of System X, Britain´s digital switching system. It also helps to explain why the Post Office insisted upon a prominent role for itself in the System X development programme. Hence the question of technological choice prior to System X constitutes far more than decorative background.

The critical mistake in the evolution of Britain´s switching systems had been the premature decision to leap from the electro-mechanical Strowger type to a fully electronic exchange. This strategy, with which the suppliers fully concurred, came to grief in 1962 as we have seen. By 1966 it was also clear to the Post Office that its intermediate choice of technology (the semi-electronic, reed-relay exchange) would itself not be ready to cope with surging telephone demand. Consequently, the Post Office was obliged to adopt a system - Crossbar - which it had never intended to use.

The significance of Crossbar, a more advanced electro-mechanical exchange than Strowger, lies in the fact that it was the first proprietary system ever adopted. Hitherto, Post Office practice was to commission systems which had been jointly developed; this gave the Post Office some assurance that the system would cater for the ´idiosyncratic´ UK network. Suddenly in need of a stop-gap, however, the Post Office accepted two proprietary Crossbar systems: one from Plessey and GEC, which the former had originally designed for export, the other an ITT system which was re-adapted for the UK network by STC. When these systems finally came on stream the results were both dreadful and chastening for the Post Office. Quite apart from the fact that it faced higher costs, as a result of the added costs of system variation, the Post Office encountered severe problems with respect to quality and delivery of Crossbar systems. So much so that it even resorted to ordering more Strowger equipment: this helps to explain the remarkable fact that, as late as 1976, over half the net expansion of the network consisted of Strowger!. (Cripps and Godley, 1978). By 1972 there were well over 100 Crossbar orders still unfulfilled and the Post Office claimed that some of these systems were not completely de-bugged until 1975. The Post Office attributed most of its problems to ´terrible´ quality control within the supplying firms. But, on this issue, it was itself culpable.

Paradoxically, the terms of its own procurement policy exacerbated the quality control problem with Crossbar exchanges. For example, the suppliers were paid 80% of their total receipts as soon as the exchange was manufactured, with the remainder paid when the exchange was successfully cut into service. The result, said one PO manager, was that the firms began 'producing like mad to get the 80% and worrying less about the installation payment'. For the Post Office at least, the Crossbar era, associated as it was with the 'arm's length' relationship, proved to be a deeply disquieting experience. Above all, it was thought to vindicate the Post Office's congenital dislike of proprietary switching equipment.

Within this context the Post Office was due to decide on the type of exchange it should order for modernization in the 1970's. Publicly, it claimed to be neutral as between the advanced Crossbar, sponsored by Plessey and GEC, and the TXE reed-relay exchange on offer from STC. (Post Office, 1972). Although a formal review of these competing systems took place in 1972, the Post Office was already committed to the STC system for a number of reasons: (1) the reed-relay exchange had the great merit of having been developed in co-operation with the Post Office (2) it appeared to offer lower maintenance costs (3) the Post Office was keen for its suppliers to adapt their 'factory cultures' to the electronic era, a policy which favoured the reed-relay exchange because it embodied far more electronic circuitry and (4) the dreadful experience with Crossbar inclined the Post Office against this proprietary exchange. Indeed, prior to the formal review, the Post Office had unsuccessfully tried to persuade Plessey and GEC to participate in developing the reed-relay exchange. For their part Plessey and GEC held out for a computer-controlled version of Crossbar which, they argued, had far more export potential than the STC offering. Equally if not more important was the fact that these two firms had incurred large sunk costs in Crossbar which they were determined to recoup. Although the Post Office privately conceded that the STC exchange had little or no export potential, it did not see this as a damning indictment because its duties related not to exports but to the needs of the UK network. The Post Office felt that its network was already dominated to an embarrassing degree by electro-mechanical exchanges, a situation which Crossbar would do little to rectify. After a difficult, but successful, battle with the Treasury to gain approval for its plans, the Post Office informed the suppliers of its intention to proceed with the TXE4 reed-relay exchange.

However, at least 2 years were lost before a modified version of this plan was approved by the (Conservative) government in 1973. The chief cause of this protracted delay was the intense opposition mounted against the plan by Plessey and GEC. Having lost their battle with the Post Office, these two firms lobbied every relevant quarter in the government, up to and including the Prime Minister's office. Skilfully, they presented their case against the Post Office not only in terms of the threat to exports but 'by threatening the government with massive unemployment in already depressed areas plus the disruption of the strategically important telephone manufacturing industry'.

(New Scientist, 1973). Playing on these raw political nerves GEC and Plessey succeeded in modifying the original intentions of the Post Office. When its plan was eventually announced, in February 1973, the Post Office declared that although it would still proceed with TXE4, its ordering of Crossbar would be increased. This result was widely interpreted as a 'brilliant coup' on the part of GEC and Plessey because, while it may have done little for exports or jobs, it provided an enormous boost to their return on capital invested in Crossbar. (New Scientist, 1973; Hills, 1984).

Although GEC and Plessey had won a short term victory, this was tempered by the realization that STC had become the leading supplier of the equipment with the more assured future. In fact, this difference was brutally underlined in the mid 1970's, when the Post Office suddenly discovered excess capacity in its exchanges. Without warning, it announced draconian cuts in its ordering of electro-mechanical exchanges. (Posner, 1977).

The battle between TXE4 and Crossbar was a dispute over an interim technology. But, in the longer term, there was little or no dispute about the fact that the future lay with computer-controlled, fully electronic exchange technology. While the battle for the medium term was being fought out at the highest political levels, a longer term strategy was struggling to emerge 'backstage', in the Advisory Group on Systems Definition (AGSD), a joint forum set up in 1968. The Post Office telecom engineers involved in this group encountered two difficulties:

(1) they were barely tolerated by the main Post Office Board and, partly because of this, they were constantly engaged in a resource battle with other telecom departments

(2) the new 'arm's length' relationship between the Post Office and its suppliers, which started in 1968, was considered wholly unsuitable for effective R+D collaboration; it had led to divergent private venture projects, and these suppliers were loathe to divulge information in the AGSD for fear of losing a competitive edge.

While the main Post Office Board welcomed the 'competitive era', because it promised to bestow greater commercial power on the Board vis-a-vis its suppliers, the telecom engineering fraternity within the Post Office saw it as a nightmare so far as technical collaboration was concerned. This was one of a series of divisions between these parties which punctuated the Ryland chairmanship, that is, between 1972-77.

After five years of discussion the AGSD was wound up in 1973 because of a widespread feeling that too much time had been devoted to conceptual issues and too little to actual development. Two of the most important conclusions at which the AGSD arrived were: (1) that the concepts embodied in System X - stored programme control, common channel signalling and modular architecture etc - would best be realized in a 'total systems strategy', rather than if they were exploited individually and (2) on the development side the stress was laid on the need for

'close interaction' between the Post Office and its suppliers. (Harris, 1979; Harris and Martin, 1981). Here it might be argued that the 'conceptual' conclusion pre-determined the developmental relationship between the Post Office and its suppliers, because it seemed to require a more co-operative, symbiotic approach to systems development than had ever existed before. If indeed there was a 'hidden' agenda here, it only served to express the collaborative relationship which both the firms and the telecom engineers wished to realize, although it was not a relationship which endeared itself to the Post Office Board. This helps to explain the most remarkable feature about the subsequent System X programme, namely, the interminable delays which afflicted it. For example, although the AGSD had been wound up in 1973, the formal relationship between the Post Office and its suppliers did not materialize until 1975; project definition did not begin in earnest until 1976; and the major development contracts were not signed until 1977.

What was the nature of these delays?. Although it is somewhat artificial to isolate specific categories of delay, since they were mutually re-inforcing, it is useful to identify three such categories: (1) commercial (2) project management and (3) engineering. Each of these merits some attention.

(1) Commercial Factors: three specific issues fall within this loose category, namely, how many firms were to be involved; what was the relationship to be between the Post Office and its suppliers; and who was to own the intellectual property rights to System X. Running through all these issues was the complicating factor of corporate rivalry among the three 'hostile brothers', Plessey, GEC and STC. From the outset the Board was determined to try to fashion a new supply-side arrangement. The three firms had evolved from the Strowger era and the Board - Ryland in particular - saw the System X era as an ideal occasion to wring more competitive practices from the suppliers. Ryland's chief ambition was to introduce a fourth supplier in the form of Pye-TMC, a UK-based subsidiary of Philips, which was able to draw on its parent's electronics expertise. This proposal met with immense opposition from the three traditional suppliers, resulting in a long and bitter dispute. The traditional suppliers once again sought to circumvent the Post Office Board by lobbying the Board's sponsor, the Department of Industry, where a newly elected Labour government proved to be sympathetic to their case. (Hills, 1984). As it turned out the Post Office was itself divided on this issue since its telecom division was firmly opposed to another entrant. The telecom division reasoned that there were already too many actors without a fourth supplier adding to these problems of over-crowding and excess capacity. This dispute was effectively settled not by any decisive action on the part of the Board or its sponsoring department, but by the collective action of the three firms. In a classic instance of closure, they simply refused to co-operate with Pye-TMC and threatened to break-off discussions with the Post Office itself. In the end the Board capitulated; all it managed to salvage was a clause in the System X development contract specifying that, under certain conditions, Pye-TMC would be able to participate in the programme. But, as it turned out, this proved to be a

pyrrhic victory for the Board since Pye-TMC was quietly forgotten for all practical purposes. More seriously, some two years were lost as a result of this costly dispute.

A second issue - that of defining the relationship between the Post Office and its suppliers - was still not fully resolved even after the main development contracts had been signed in 1976. The core problem here was that the Post Office Board insisted upon having collaborative development, followed by cost investigation and then competitive procurement. This issue became more important (for the Board) in the wake of the abortive attempt to introduce Pye-TMC. To this end the Board refused to give the suppliers any firm guarantee on future orders for System X exchanges and this, in turn, led to 'engineering' delays as we will see later. Anxious to press ahead as quickly as possible, the telecom division became exasperated with its Board's policy stance. For its part the Board, worried by the initially high cash-flow pressures of the programme, felt that its telecom division was too willing to accede to the demands of the suppliers for guaranteed orders. In the Board's view this would commit the Post Office in advance to the suppliers, thereby removing its bargaining power and foreclosing alternative sources of supply. This position was passionately held by some members of the Board, one of whom asked: 'why should the Post Office give the firms a guarantee which would make us beholden to them?. Afterall, System X was our thing - we were the sponsors, we gave the directions and we wanted to decide how it was used. It was for us to control and take responsibility'. The dilemma stemmed from the difficulty of moving from collaborative development to competitive supply, a problem which never arose in France and the FRG because a single supplier was responsible for development and supply. Eventually, the Board was forced to relax its position because the suppliers refused to commit engineering resources until they had received firm orders for the finished product. Indeed, until such orders appeared in 1977, the three suppliers considered System X to be a pure development programme: they insisted that it was not a manufacturing project!.

The final issue to be mentioned here concerns the debate over the ownership of the intellectual property rights to System X. The Post Office maintained that since it was largely responsible for the design, together with the fact that it had funded the entire programme, it had a legitimate claim on these rights. This dispute dragged on for a number of years until, in 1980, it was decided that these rights could be vested in the supplying firms on the condition that the Post Office had free access to them. As we shall see, this issue complicated the search for a common export strategy.

(2) Project Management: although System X was a collaborative development programme, the Post Office made it quite clear that it was assuming the lead as regards project management. This was by no means the only model for it to adopt. For instance, the Post Office might have followed the MoD's example in the Ptarmigan project, in which the MoD supervised the whole project, but sub-contracted the actual project management role

to Plessey, the principal contractor. This procurement model had a number of advantages over that of the Post Office: (1) it ensured that the roles of customer and supplier were well-defined (2) in particular it meant that the task of specifying the requirements was kept separate from the task of achieving them and (3) above all it meant that the customer had a clear idea of where blame could be allotted, and pressure applied, in the event of slippage. However, the Post Office eschewed this model. At the time when the relationship was being conceived the Post Office was dissatisfied with the general performance of its suppliers and this made it reluctant to cede centralized control to any one of them. Centralized control was itself deemed essential because the Post Office saw it as a means to reduce the extra costs associated with the proliferation of designs: the Post Office was extremely nervous about this problem given its experience with the proprietary Crossbar exchanges. However, a confidential audit carried out for the Department of Industry concluded that such was the inertia within the Post Office that it was 'unfortunate that circumstances encouraged the PO to take on the project management role - a role that does not suit its organization and ethos'. (NEB, 1978).

As a result of its financial and technical dominance within the project, the Post Office tended towards rigid and over-elaborate specifications for its sub-systems, thus adding to the delays because development contracts took longer to negotiate and longer to engineer. Once underway, however, the decision-making process became retarded by a complex array of committees, in which even minor details had to be authorized from on high within the Post Office.

Reviewing progress in 1976 the Carter committee identified poor project management as the major cause for worry, so much so that there were grounds for the 'gravest misgivings'. It criticized the PO because the management of the project was not receiving the status it deserved, and for expecting the firms to co-operate in a project with 'no firm orders at the end of it, and which may yield a product with no export market at all'. As for the firms, it bemoaned the fact that they were not a 'natural team' and criticized the fact that these 'jealously independent manufacturers' rendered the project management task that much more difficult. (DoI, 1977). However, its other main criticism - that the PO seemed to be in no great hurry to introduce System X - showed how little the committee understood the conflicts within the Post Office: the Board may have been stalling for reasons to which we have already referred, but the telecom division was desperately keen to proceed as fast as possible.

Project management improved after 1977, following the appointment of a new chairman together with a new director for telecoms. In 1978 these two 'outsiders' decided to seek external advice on project management from the US corporation, Bechtel. Apart from urging the PO to adopt a computer-based system to monitor progress and to control slippage, Bechtel concluded that (1) the PO was not assertive enough with its collaborators and (2) there were too many actors involved in the

project. Here, however, the PO was not well placed to exert its full customer power over its suppliers because it was itself part of the collaborative team. In contrast, the DGT in France and the DBP in West Germany were better placed in this respect because, standing outside the development process, these were able to bargain more forcefully with their suppliers. Moreover, the fact that the UK had four actors developing System X, with at least two operating sites per actor, made the development process more complicated than it was in either France or the FRG: it placed greater demands on a co-ordinated engineering effort and, as we will see, the plurality of sites made it that much more difficult to reduce unit costs.

(3) The Engineering Challenge: actual engineering work did not begin in earnest until 1977, because the firms refused to commit production resources to a project for which no orders had been placed. Indeed, even at this stage Plessey was still trying to push for Crossbar and refused to acknowledge the relevance of System X. This 'engineering' problem was in fact a commercial problem, stemming from the PO's refusal to place a single order. Against the background of mounting political concern about slippage, the PO's director for engineering finally persuaded the chairman that no engineering headway would be made unless some orders were forthcoming. Thus pressed, the chairman agreed to place orders for 20 System X exchanges, the so-called 'Ryland Pull-Forwards'. Once underway the major issues revolved around how to forge a commom engineering culture; how to accelerate design and production cycles; how to manage the software challenge; and how to reduce costs.

So far as the Post Office side was concerned one of the most intractable problems concerned the lack of a common equipment base within the three firms and their divergent working practices. The PO quickly discovered that it was not enough to win over the engineering teams because:

'after we had got all the engineers from the firms to agree on the need for common equipment and common working practices, these would be unable to deliver. The reason for this was that their commercial superiors refused to write-off existing equipment and this made it very difficult to get going on the engineering side'.

Once the PO realized what huge savings it could make if all the delays were overcome - savings which one manager estimated to be around £1 million per week - a new drive was undertaken in 1978 to accelerate the project. Some of the main bottlenecks resulted from a lack of investment on the part of the firms in production capacity (eg PCB's) and in new process technology (eg CAD/CAM systems). Perversely, the PO discovered that its own cost-plus contract contributed to this because:

'the firms got richer by minimizing capital employed: that way they were able to convert the 13% return on cost, allowed by the Treasury formula for cost-plus contracts, into a higher return on capital employed. The cost-plus environment encouraged skimping on investment. It provided no incentive to invest, to

innovate or to raise efficiency'.

To overcome these bottlenecks the PO was driven to finance new PCB capacity within the firms as well as supplying each of them with a common CAD/CAM system. This helped to compress design and production cycles.

Apart from these bottlenecks all four parties acknowledged that the most difficult bottleneck of all was in the field of software engineering. In retrospect it seems little short of amazing that the System X project, the largest civilian software task ever undertaken in the UK, had no participant from the software sector. Defending this omission the PO claimed that there were already too many actors involved; besides, it believed that it was easier for telecom firms to acquire software expertise than vice versa. However valid this decision was at the time, there is little doubt that all four parties grossly under-estimated the complexity of the software challenge. Despite the UK's reputation as an island of software expertise, the traditional UK strengths are in areas like esoteric academic analysis, rather than in diffuse, real-time operations such as telecommunications. Those telecom firms which had fared best with the software challenge - Western Electric, Ericsson, Northern Telecom - had done so because they had the benefit of years of experience in applying computer control (ie stored programme control) to their Crossbar and reed-relay exchanges. For them the digital era marked a second generation of computer control, whereas System X was the UK's first attempt at applying software to switching. (Manasian, 1979). Ironically, the reason the PO had ruled out stored programme control for its earlier exchanges was that it would have added to costs. (NEB, 1978).

The design, 'production' and testing of software modules are exacting enough processes within a single firm. Four separate design teams, scattered over at least four different locations, made these tasks excruciatingly difficult since software modules had to be transferred between firms and had to interface with each other. Not surprisingly, one firm spoke of its 'software nightmare', while another frankly conceded that software presented 'a colossal problem'. What compounded matters was a shortage of software skills within the firms, indeed within the UK as a whole. Since the software challenge had been under-estimated the output of electronic and software engineers fell below what was required. Although this skills bottleneck was in no way confined to the UK, it appears to have been more of a problem in the UK than in France, for example: not only was System X far more software-intensive than the E10, but France mobilized a national training programme to support its modernization plan. (Corre, 1976).

Last but not least there was the problem of how to reduce the excessive cost of System X. The collaborative nature of the project was itself a factor in raising costs on both the R+D side as well as in production. The division of labour between the firms was such that GEC developed the central processor (ie the computer), Plessey did the switching system while STC was responsible for the network management systems. As well as

having an R+D team for its own sub-project, each firm was expected to have expertise in the others because, when development was over, the firms would be competing to supply the full system. Given this collaborative structure there was a good deal of duplication, which was 'doubly unfortunate in that the duplication occurs in those areas where there is a shortage of staff anyway'. (NEB, 1978). On the R+D side the PO became deeply worried about the cost and lack of power of the central processor, with which all sub-systems had to communicate. This had fallen way behind schedule, partly because of GEC's lack of computer expertise, partly because the specifications kept changing over time. Such was the concern that the PO took the extraordinary step of requiring GEC to sub-contract the processor to a Californian design company. The result, according to the Post Office, was a product which was 80 times better in terms of price/performance than the GEC equivalent.

On the production side the PO was fully aware that three firms was a grossly excessive number so far as the manufacturing needs of System X were concerned. A PO delegation had been sent to the US in 1973 to learn about future requirements and it returned with dramatic findings: for example, the PO suddenly realized that a very small workforce of some 3,000 - compared to the 30,000 then engaged - was all that was needed once System X reached full production. From the outset then the PO realized that a rationalization of the supply side was essential if production costs were to be reduced. In fact this theme was seized upon by the out-going chairman in a comparison of the UK and US situations. Western Electric, he said, had the capacity to produce nearly one million lines of electronic switching in each of its five factories; the UK, however, had the capacity to produce one million lines, but this was 'dispersed over nine towns - not factories but towns'. (Ryland, 1976). Clearly, by any technical standards the UK supply industry cried out for rationalization.

* * *

Once the basic development stage was finished, around 1979-80, the emphasis shifted to enhancing System X and further cost reduction, and this inevitably raised the vexed issue of rationalizing the fragmented supply side. This issue had been addressed on a number of occasions in the past: in 1964 an internal report recommended that the PO should absorb one of its suppliers.(Post Office, 1964); in 1976 the Post Office chairman proposed that the three manufacturers and the PO should merge their telecom activities into a 'partnership of the public and private sectors'.(Ryland, 1976). Nothing came of either proposal.

A more significant attempt to promote rationalization emerged in 1978, sponsored jointly by the DoI and the National Enterprise Board and endorsed with alacrity by the Post Office. Although this initiative was designed to reorganize the supply side, it was originally born out of the DoI's desire to ascertain the overall viability of System X, particularly its export

potential. Throughout the System X development programme the DoI had little or no independent knowledge of what was going on: it was totally dependent on the Post Office for information and the PO resented its interference. In fact, the Post Office Act contained no provision for the DoI to supervise or approve the R+D activities of the Post Office, and the PO used this statutory omission to the full by insisting that the System X project was an 'R+D issue'. Troubled by the secrecy of the Post Office, the DoI initiated a series of audits in 1976 and 1977 to assess the viability of System X; but, since these tended to be dominated by personnel from or nominated by the Post Office, it was hardly surprising that the project was always endorsed. Within the DoI itself the overriding attitude was against 'rocking the boat', because too much time and too many resources had already been committed - the classic Whitehall response, according to one member of the Carter committee who felt that the DoI and the Carter team should have demanded a radical reorganization of the entire System X programme.

One of the audits commissioned by the DoI was undertaken by the NEB and this confidential report was submitted to the DoI in 1978. As regards the supply side problem the NEB proposed a major rationalization to shave the number of suppliers from three to two, so as to reduce excessive competition at home and in export markets. It therefore recommended that Plessey and STC should merge their telecom activities. Although both the DoI and the Post Office tried to foment such a merger, and while the three firms themselves agreed that one of them should withdraw, the proposal foundered on intense corporate rivalry: each firm insisted on its 'right' to remain a sovereign supplier. Indeed, when the PO chairman tried to pressure STC out in 1979, Lord Caccia and Sir Kenneth Corfield of STC appealed directly to the DoI, possibly higher, and succeeded in winning political support to remain in the System X programme. The DoI was unwilling to exert pressure to secure a rationalization, preferring, instead, to wait for the corporate parties to reach agreement among themselves; a philosophy which simply sanctified a status quo to which it was opposed. For their part the firms were well aware of what resources they could muster should any one of them face expulsion. For instance, one managing director spoke of two types of resource:

'First, many locations were in development areas and we realized that this was a raw political nerve. Secondly, there were legal contracts and, if the PO threatened to unilaterally tear these up, we could take to the courts'.

In this way the firms felt able to defend themselves if the DoI felt inclined to force a rationalization. But, more pertinently, the DoI was not so inclined because, as one Labour minister frankly conceded, 'the DoI would only intervene if the industry wanted intervention'!.

Although it had failed to effect a merger the DoI kept up its pressure to improve the export potential of System X. Despite protests to the contrary, the PO did not pay any serious attention to export potential until a new management team took over in 1977. Thereafter the PO felt that it was in its own

interest to have a supplying industry which flourished in export markets; that is to say, it no longer took refuge in the letter of the 1969 Act, which absolved it of any formal export responsibility. However, the firms themselves showed little zeal on the export front until the late 1970´s. In its private audit the NEB had been extremely critical of the three firms, saying that it was ´taken aback by the lack of resources being devoted to overseas marketing efforts, and does not agree with the companies that it is much too soon to start expanding their efforts´.(NEB, 1978). Under the stimulus of intense political pressure the four parties in System X finally agreed to create a joint export company, British Telecommunications Systems, launched in April 1979, with the aim of winning 10% of the available world market within ten years. BTS, however, proved to be a thoroughly unhappy experience, fractured by bitter corporate rivalry; while STC´s philosophy was to loss-lead to break into new export markets, GEC stressed the need for further state support. Indeed, it was not at all clear if the firms saw exports as vital to their existence because, as one of them privately conceded: ´even if we do not sell a single line abroad, System X will be profitable for us´. (Crisp, 1981).

Paradoxically, while the Labour government eschewed direct intervention in the System X programme, the neo-liberal Thatcher administration adopted a more intolerant view of the existing supply arrangements. It was encouraged to take this view by three factors: (1) the basic System X development stage had finished (2) BT´s new chairman (Jefferson), saw the liberalization of telecoms as an ideal opportunity to secure some form of rationalization and (3) Plessey had been lobbying the DoI in private, claiming that it should be made the single supplier of System X because existing arrangements deprived each firm of the necessary economies of scale. Once it became clear that the three suppliers were unable to rationalize themselves, the DoI gave its blessing to a BT-sponsored rationalization.

In May 1982 BT made its move. Without warning it announced that it was looking for a single UK contractor from which to source 70% of its digital exchange needs, with the other 30% being offered to a foreign supplier, and it gave the firms a mere four weeks to prepare their bids. This ´bombshell´ was not as unexpected as is often thought; Plessey was prepared for such news, having been partly instrumental in provoking it, while STC had advanced warning through its informal access to the DoI. So in fact GEC was the only firm with no fore-knowledge, partly because of a growing antipathy towards it within the DoI, and partly because GEC´s HQ had not been sufficiently appraised by its own telecom division about GEC´s problems in the System X programme. Anxious to maintain a public non-interventionist stance, the government used a part-time advisor to the DoI, and a well-connected City ´fixer´, as its unofficial intermediary to negotiate the deal. Throughout the negotiations Plessey was the firm favourite: it was seen to be more dependent on telecoms than was GEC and its record on System X had been better than either of its rivals. STC appeared to be the obvious candidate for expulsion: being a subsidiary of ITT was a liability, but the deciding factor was that STC had run into dire software problems on its System X work. As a result STC was eased out on

favourable terms, having won for itself an exclusive right to supply BT with an interim exchange, the TXE4A, estimated to be worth some £100m annually for five years. Although BT tried to expel GEC as well, it relented in the face of intense political lobbying from Lord Weinstock and because, at that time, no single firm was capable of supplying an entire System X exchange on its own. In the event Plessey was made the principal contractor, GEC the sub-contractor.

The long-overdue rationalization of 1982 may have closed one chapter in the saga of System X, by easing the fragmented supply side, but it signalled new, and no less daunting, challenges for the remaining two suppliers. For one thing the terms of the 1982 'heads of agreement' saw BT setting much tougher conditions as regards price, quality and delivery; and, within a year, Plessey and GEC were expected to supply digital exchanges on a fully competitive basis with one another. Furthermore, while the 1982 agreement committed BT to buying System X as its 'principal system' until October 1987, BT made it clear that, thereafter, the UK firms would have to compete more openly with Thorn-Ericsson, which BT selected as its 'foreign' supplier in March 1985. Finally, the 1982 agreement decreed that BT would cease all funding of System X enhancement costs in 1986-87, thus placing still further pressure on Plessey and GEC because these costs can amount to £60-£100m per annum. These added pressures persuaded both Plessey and GEC that their System X activities needed to be merged but, ever since 1983, the two have been unable to agree on a mutually acceptable solution. GEC's unsuccessful takeover bid for Plessey at the end of 1985 was thus only the most visible attempt to break this deadlock.

Although the two UK firms claim that their capacity is under-utilized as a result of Thorn-Ericsson's entry, they have been unable to meet agreed delivery dates on their existing System X orders, largely because of difficulties in gearing up for mass production. As a result, BT's installation programme has fallen behind schedule since the first normal trunk exchange was opened in January 1984; indeed, towards the end of 1985 this programme was some 15 months behind schedule. In consequence, BT was forced, as a stop-gap measure, to spend some `100m in renovating older TXE4 exchanges so that they could offer some of the computerised services available on System X.

Even though BT is aiming to purchase 2-3 million digital lines a year for the rest of the decade, as part of its accelerated modernization programme, Plessey and GEC are deeply disturbed by the fact that they no longer have this BT market to themselves. What is more disturbing, from a wider perspective, is that System X has yet to win a major export order. In the absence of such orders it becomes even less likely that the UK digital exchange market - once the fiefdom of three national suppliers - can sustain two independent UK manufacturers for much longer. Indeed, over the medium term, it is doubtful if a single UK supplier can survive in this sector without international collaboration, given the burgeoning development costs of a new generation of digital exchange.

* * * * *

What, then, are the consequences and the lessons of the UK's troubled history in the public switching arena?. The most palpable consequence for BT is that its network is burdened with huge tracts of obsolete exchange equipment, as is shown in the following table:

Numbers and Types of Exchange in BT's Network 1984 (1986)

	Local Exchanges	Trunk Exchanges	International Exchanges
Strowger	3708 (3345)	331 (333)	- (-)
Crossbar	571 (549)	126 (121)	6 (5)
TXE	1965 (2116)	- (-)	- (-)
Digital	48 (157)	2 (25)	1 (1)
Total	6292 (6167)	459 (479)	7 (6)

Sources: BT Prospectus, 1984; BT Annual Report and Accounts, 1986

When set against Mercury's new, all-digital network, BT is clearly at a real disadvantage here, at least so far as the lucrative business user market is concerned. Hence BT's determination to accelerate its digital exchange installation programme - as can be seen from the figures for 1986 - and its decision to use Thorn-Ericsson as a 'pacing-horse' to press Plessey and GEC on price, quality and delivery dates. The main consequence for the traditional UK suppliers is that they have not had a credible product for export since the Strowger era. Had such a product existed they would have been in a better position to offset some of the large scale job loss - much of it in development regions - associated with the transition from electro-mechanical to electronic switching systems.

As regards the lessons to be derived from this experience the chief ones would seem to revolve around such issues as:

(1) the exceedingly narrow conception which successive governments had of the PO's role in the national economy. Some of the technical mistakes with which the PO is identified could equally well be attributed to central government. For example, had the PO not been subject stringent financial controls its decision to stay with Strowger technology and reject Crossbar may not have occurred. (Hills, 1984). Later, the revolutionary stored programme control system was rejected by the PO because only with an inferior control system did the 'economics look right' on the TXE4 exchange. (NEB, 1978). With respect to System X, the timescale was in part governed by the PO's fears

that too rapid a pace would have serious effects on its internal cash-flow. On this issue the NEB had (privately) castigated the Labour government, saying that it was 'important that the government does not merely assess the PO in the light of its profit and loss account, but takes into account the wider benefits of a modern system'. (NEB, 1978). Again, on the critical issue of exports, the culpability of central government needs to be given some prominence. We have tried to show that the terms of reference set for the PO were such that the PO was quite within its statutory rights when it insisted that it had no remit to consider the export potential of the equipment which it specified and procured. So, apart from the private suppliers, there was little or no incentive or lobby to maximise income from exports, a situation equivalent to 'Hamlet without the prince'. (Cripps and Godley, 1978). In each of these ways the PO should have been assessed, not in narrow cost accounting terms, but with respect to the pervasive effects which its actions had on the wider economy, especially on the supply and use of advanced technology.

(2) the poor relationship between the PO and its suppliers stemmed, in part, from the fact that their respective roles and responsibilities were not sufficiently well defined. Here the PO could be said to have exercised both too much and too little power vis-a-vis its suppliers. Its domineering role in setting specifications and in project management are examples of the former. In these cases the PO often appeared to be technically arrogant; this self-confidence came from its belief that its own R+D resources were far superior to those of its suppliers. But, equally important, it exercised too little authority in discriminating between its suppliers. So as not to be accused of favouritism, it did not insist on limiting the number of suppliers on the System X programme, even though it knew that three was too many. (Large, 1982). Nor did it discriminate enough in favour of best practice. The PO's defence was that it was not politically feasible for it to use its power in this way, and we have shown this to be a credible defence. Paradoxically, Labour governments proved to be more willing to over-rule the PO in response to lobbying from the suppliers. This was partly because they were more sensitive to threats of unemployment in development regions but, also, because they were wary of undermining the autonomy of the firm. Among other things this illustrates the reciprocity of power relations even in a sector where the state would appear to be able to dictate the rules of the game.

(3) the private equipment suppliers, though far from powerless, too readily accepted the role of sub-contractors. With very few exceptions (eg Plessey's Pentex exchange) they have seldom designed switching equipment unless the PO was known to be underwriting it. To some extent they relied upon the PO's formidable R+D resources as a surrogate for expanding their own in-house resources. Furthermore, they showed little appetite for setting up overseas marketing networks. On both counts it could be argued that it was quite rational for them to act in this way, given the promise of a captive home market. But the most that can be said for this view is that it was a rational short-term option. It is not sufficient to indict the firms for

their poor performance; concerned as they were to protect their earnings per share, they were simply exploiting a captive state market. Much of the burden of responsibility here must fall on the PO and central government. Compared with NTT and the DGT - the PO's counterparts in Japan and France - the PO operated a relatively weak system of incentives and penalties in its procurement practice. On the incentive side we have seen that the cost-plus contracts on System X actually operated as a dis-incentive to innovation and investment. As regards penalties, the firms themselves conceded that credible penalties for poor performance on System X only emerged with the 1982 reorganization. Because of the political limits within which the PO was forced to operate, neither the DoI, which was deperately lacking in independent expertise, nor central government, which assessed the PO in the narrowest of accounting terms, are beyond reproach for this state of affairs.

CONCLUSIONS AND IMPLICATIONS

Does the state necessarily enjoy more positive power vis-a-vis private firms in public markets?. If the career of telecoms as a public sector market is any guide the evidence suggests that it does not. By and large the public authorities - namely, the government and the Post Office - were rarely in a position to realize the powers normally associated with a major customer. Inordinately dependent upon its traditional private suppliers, a dependence reinforced by a public monopoly regime and its corollary, 'industrial patriotism', the Post Office was forced to accept these parameters as given. For their part the traditional suppliers were shown to have interests which were far from identical with those of the Post Office. Within this context successive governments proved themselves unable to exert much (positive) influence, partly because a radical reorganization would inevitably compromise the autonomy of the firm. Given the way in which this monopoly regime was operated it is not too much to say that the traditional suppliers had 'captured' the Post Office and its public market.

By breaching the public monopoly and, more especially, by privatizing BT, the Thatcher government circumvented the problem which its predecessors had found so intractable, namely, how to introduce credible threats so as to overcome the deep inertia within the 'telecom club'. In the neo-liberal scenario such inertia was seen as an inherent feature of the club, which no amount of reforming zeal would overcome. One of the charms of liberalization and privatization, in this scenario, is that these policies expose firms to the most credible threat of all - bankruptcy - without the state having to interfere - at least not directly - with the autonomy of the firm.

Within the neo-liberal camp it was hoped that breaching the monopoly and privatizing BT would eventually remove telecommunications from the political arena. Notwithstanding the creation of Oftel it was hoped that, in time, the market would itself assume the main burden of regulation; that is to

say, the growth of competition would render regulatory authorities superfluous. But as much as the government likes to present liberalization and privatization as wholly consistent elements of the same pro-competitive process, they are not, as we have seen. In particular the asymmetry in market power between BT and its fledgling rivals makes the search for a 'perfect market' in telecoms something of a chimera. And nowhere is this more apparent than in the basic network segment of the market where, because of substantial economies of scale and scope, 'natural monopoly' tendencies are far from spent. (Ergas, 1985). All in all there is a cocktail of issues - like BT's potential predatory behaviour, rising charges for residential users, the viability of indigenous suppliers - which look set to place more, rather than less, demands on the regulatory process. It is naive in the extreme, therefore, to suppose that telecommunications will become less politicized in the future.

If the UK telecom market falls short of the 'free-for-all' that now appears to exist in the US, it is still far and away the most liberalised in Western Europe. This raises one of the most fascinating questions of all, namely, why such uneven development within Western Europe when each country appears to confront broadly similar pressures?. Here we need to recognise that technological change can be negotiated and accomodated in very different forms at both a company and a country level. Starting from this simple, but fundamental, point the following four factors help to explain the divergent paths that have been followed, up until now at least, in the UK on one side and in France and the FRG on the other, where little liberalization has occurred and certainly no privatization:

(1) Political Culture: constitutional constraints in France and the FRG limit the scope for radical change in the telecom sector in each of these countries. In the FRG, for example, the Basic Law stipulates that the Bundespost must be an 'administration owned by the federation' and a two-thirds majority in the Bundestag is required to remove this constraint. (Morgan and Webber, 1987). An additional constraint here would be the strength of a public service class and a wider commitment to the public service tradition in both countries. Unlike BT, which was a public corporation before it was privatized, the DGT in France and the Bundespost in the FRG are still public administrations.

(2) Record of the 'Telecom Club': the performance of the French and German clubs has not attracted the same degree of criticism as in the UK because, on balance, they are perceived to have performed better as regards technological innovation and exports.

(3) Character of Ruling Party: although the significance between Left and Right parties should not be taken too far, the socialist interregnum in France clearly helps to explain why liberalization and privatization were not on the political agenda between 1981-86. What is more significant is that major policy differences remain, even though each of these three

countries is now governed by a right-wing administration. Conservative governments in France and the FRG are a good deal more cautious and pragmatic than the Thatcher government. This is partly attributable to the fact that these continental administrations are far more committed to 'industrial patriotism'; they are therefore more anxious about potential threats to their indigenous industry.

(4) Structure and Role of Business Users: the demands placed on the telecom sector in each of these countries vary a good deal, especially so far as business users are concerned. The stance adopted by these users is conditioned not simply by the performance of the supply side but, also, by the nature of the business user, its size and sophistication etc. The point to establish here is that the UK has the most concentrated industrial structure of the three countries, with a relatively higher penetration of large multinationals. These large, multi-site companies have sophisticated needs, especially for data communications. And, because the UK is the most favoured European location for US multinationals, it has been more exposed to demands for a US-style service. Anxious to preserve its status as the major transatlantic hub in Europe, the UK has also been more sensitive to these demands. In this category of advanced users we must never forget the City, which probably contains the largest concentration of advanced business users in Western Europe. Indeed, the threat to the City's position as an international financial centre was one of the factors seized upon by the Thatcher government to rationalize the need for radical surgery in the telecom field. In contrast, the industrial structure of the FRG is more fragmented, with a higher proportion of small and medium sized enterprises, and their needs are relatively well served by the Bundespost's emphasis on public networks. By and large it is not these who are critical of the public monopoly in Germany, but the large multinationals. (Webber, 1987). In addition to the uneven structure of the business user population, it appears that UK users are better organized and more vocal than their counterparts in France and the FRG. Of course, this partly reflects the uneven structure of users, with larger users having the expertise, the time and the resources to become more vocal political actors.

These factors show that the pressure on the telecom sector in each of these countries has been from uniform, and this helps to explain the uneven development which we now see in Western Europe. The UK occupies a unique position because its supply side was perceived to be that much weaker and business user demands were that much greater. In themselves, however, these factors are not sufficient to explain the radical transformation which has occurred in the UK since 1979. Aided and abetted as it undoubtedly was by these factors, this transformation would probably not have materialized had it not been for the distinctive ideological project of the Thatcher government. To support this counterfactual claim there are strong grounds for thinking that the Thatcher government was acting autonomously in privatizing BT and in licensing Mercury: in neither case was it simply responding to the demands of business users. The TUA, for example, seemed content to accept that BT's basic monopoly

should remain inviolate; while the TMA was far from happy with the government's proposals to privatize BT. In each case the government was itself the main driving force.

A new configuration of winners and losers has been produced by this new neo-liberal telecom regime. The main beneficiaries are large business users, who now enjoy lower charges, particularly on international routes, and greater freedom of equipment choice. However, a survey of 200 large business users found that nearly two-thirds of them had experienced little or no improvement in the quality of BT's service since privatization. (National Utility Services, 1987). Among the other beneficiaries are BT, Mercury, Thorn-Ericsson, Racal and a number of other new suppliers, many of whom are foreign firms either importing to, or producing in, the UK market. Among the losers three categories stand out: the traditional equipment suppliers, who have been deprived of a captured market; BT's trades unions, who have lost the bargaining power associated with a public monopoly; and residential customers, particularly those dependent on local calls, because these charges have undergone the steepest increase - so much so that the UK is now reputed to have some of the highest local charges in the OECD.

Before concluding with a rough balance sheet of effects it is worth speculating upon what the implications of a neo-liberal regime might be with respect to (1) the provision of an advanced IT infrastructure (2) promoting regional development (3) stemming the decline of an indigenous R+D capability and (4) fostering a European strategy in telecommunications:

(1) a national broadband cable network would form an important component of an advanced IT infrastructure in the UK. However, this is not going to emerge under neo-liberal conditions. Firstly, because a national network has been forsaken in favour of a small number of localised networks in which cabled services have been largely reduced to cable TV, and these initiatives command little if any state support. And, secondly, because the most economical vehicle - BT's own local network - is ruled out on pro-competitive grounds, with the result that BT is barred from offering any service other than telephony over its local network. If BT were allowed to be both a common carrier and a vendor of broadband services this would provide an enormous incentive for BT to modernise its local network at the same time. As it is, however, the local network is now being left behind in BT's modernization programme because, being massively under-utilized, BT lacks the incentive to up-grade it. (Jefferson, 1986). Consequently, a potentially important infrastructure is unlikely to emerge because of an exaggersted faith in the market and because of excessive restrictions on BT.

(2) what are the implications for regional development in Britain?. Peripheral regions are concerned that BT's universal service obligations only relate to telephony and do not extend to IT services. Since these services are user-driven the fear is that they will tend to be concentrated in those locations, like the South East, where the most sophisticated business users

are already based, thus further enhancing the locational attractions of the South over the North. Furthermore, with higher residential charges, access to basic telephony will become more difficult for those 5 million or so households that are currently without a telephone, most of which are to be found in the less prosperous regions. As a result there now seems less prospect of bridging the gap between the 'information rich' and the 'information poor', a cleavage which has social as well as spatial dimensions

(3) one of the effects of privatizing BT is that its R+D facilities, once a public asset to which indigenous firms had access, have now become a proprietary resource from which they are excluded. Since the promotion of R+D is one of its duties, Oftel is now concerned that the UK telecom firms may not have a sufficiently strong R+D base to retain an effective presence in the industry. To this end it has floated the idea of a national R+D facility, which would diffuse its results to all UK firms. Here, however, it was forced to acknowledge that 'BT's immediate commercial interests may now tell against substantial involvement in basic long-term research'. (Oftel, 1985). The question marks here are twofold: to what extent will BT be able to assist the UK's pedestrian IT industry and, secondly, will BT's own R+D strategy succumb to the 'British disease', that is to say, short-term corporate horizons linked to a low level of industry-financed R+D?.

(4) as a private company subject to short-term pressures, BT appears to have little sympathy for EEC efforts to create greater European collaboration in telecommunications beyond uniform standards and a common market. For example, the EEC strategy envisages a gradual evolution of the existing telephone network into an Integrated Services Digital Network and, from this, into an Integrated Broadband Network, both of which would unify currently separate networks for telephony, data, text etc. (CEC, 1986). However, BT has strong reservations about this network strategy: it feels that ISDN is not a sufficiently market-led development and, because of this, network planners have to make risky assumptions about the future needs of business users. Obliged to be more responsive to the current demands of the market than its counterparts in France or the FRG, BT feels that its strategy must therefore be more user-driven. Time alone will decide how far BT's new status is an impediment to further European collaboration and to what extent it is a constraint on longer term network planning in the UK.

To date, however, the neo-liberal balance sheet reveals some mixed results, as is clear from the new configuration of winners and losers. Overall, the benefits which have accrued to new suppliers and, more importantly, to business users must be set against the costs. And, as we have seen, some of these costs are to be found in a deteriorating trade deficit, growing dependence on foreign-designed technology and an indigenous industry which is exposed to liberalization at home, without having gained reciprocal access to closed markets abroad. Without heroic optimism, it is difficult to see the UK telecom industry regenerating itself in these circumstances. The problem is of

course, that an even greater optimism is required to think that the traditional 'telecom club' is any longer a feasible alternative to the 'cold shower' of neo-liberalism.

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