## Enterprise vs Product Logic: The Industrial Reorganisation Corp oration and the Rationalisation of the British Electrical/Electronics Industry

Prepared for Business History

Authors:

Dr Anthony Gandy

[tpsgandy@btopenworld.com](mailto:tgandy@ifslearning.ac.uk)

Prudential Regulation Authority, Bank of England

And

Dr Roy Edwards

Southampton Business School, University of Southampton SO17 1BJ, UK

[R.A.Edwards@soton.ac.uk](mailto:R.A.Edwards@soton.ac.uk)

## Abstract:

This paper examines how the corporate economy was shaped by government intervention through the facilitation of mergers by the Industrial Reorganisation Corporation (IRC) during the late 1960s. We focus on the IRC-led realignment of the electrical/electronics sector applying a conceptual framework to archival material relating to this sector. We find evidence that the mergers were informed by an enterprise-level view of the market while disregarding product-level decision-making and conclude that the IRC vision for the sector widely ignored the product-level logic associated with the designing, making and selling functions. Instead, they relied on assessments of enterprise-level management character.

Key words: Capabilities; Enterprise and Product Logic; Electrical and Electronics Industry; Industrial Policy; GEC

## Introduction

The purpose of this paper is to explore the nature of the industrial intervention in late 1960s by focusing on the activity of the UK’s Industrial Reorganisation Corporation (IRC). We revisit a well-known case involving efforts to restructure the UK’s electrical manufacturing sector, by using documents from the IRC declassified from 2000 in the UK National Archives. We specifically discuss how the IRC conceptualised visions of industrial structure which focused on institutional scale compared to alternative, product focused, strategies presented by enterprises which had a different vision of the sector. In this paper we use a historical approach to explore the process of intervention based upon what we call product level and enterprise level logics that frame the execution of the business model. In so doing we explore how the IRC shaped their vision of corporate strategy and organisation to reorganise the large electrical and electronic sector then present in the UK economy.

The ability of the state to intervene in business and economic activity has long been a source of debate among historians and commentators[[1]](#endnote-2). Proponents and detractors of government intervention seek to justify their position by looking at political and administrative structures and associated welfare outcomes. One strand of this literature relates to industrial policy and the role of the state in shaping the organisational, investment and technological choices within the business arena. Indeed, the role of the state in the 20th century helped to define what Hannah refers to as the rise of the corporate economy. The following paper considers the example of the state sponsored reorganisation of UK electrical/electronic manufacturing during the period 1966 to 1968. This period saw the Labour government grasp the importance of engineering and science as exemplified by Prime Minister Harold Wilson’s 1963 Labour Party conference speech arguing that Britain’s future would be forged in the “white heat” of a technology revolution[[2]](#endnote-3). The resulting economic strategy required government to ‘nudge’ private enterprise in the ‘right’ direction, with intervention short of nationalisation. This was to be achieved within the context of a national plan and the creation of what was referred to as a government merchant bank - the IRC. This paper begins by introducing the IRC and then outlining a framework for investigating their interventions in the electrical/electronics industry and how their support for a greatly expanded General Electric Company (GEC) under the leadership of Arnold Weinstock contrasted with the product-focused visions of rival enterprises. The conclusion reviews our approach to analysing this and other interventions and how product-led decision making can be swept aside in the search of organisational scale.

Creating the IRC

In the immediate post-war period, state support had been directed at encouraging British industry to develop new technologies, a role played, for example, by the National Research Development Corporation, (NRDC) whose investments included early computers and hovercraft[[3]](#endnote-4). Following the 1964 election win by the Labour Party, the new government sought to formalise its rationale and processes for the large-scale rationalisation of British manufacturing. The focus of this was the National Plan published as a white paper which outlined plans for the reorganisation and rationalisation of industry[[4]](#endnote-5). While the government recognised that, with cooperation from industry and banks, a number of industries had already been substantially reorganised through merger, acquisitions and regroupings, additional support was needed to encourage more focused attempts to create economies of scale and greater specialization to compete in global markets. The ultimate goal of government was to improve both the employment and balance of payments situations through improving the competitiveness of British enterprises. To achieve these aims, two key ministries were formed. The Department of Economic Affairs (DEA) was established to strengthen “the country’s ability to export, for saving on imports and for increasing productivity”[[5]](#endnote-6). The second key ministry was the Ministry of Technology (MinTech), established to support “the introduction and application of scientific methods to industry”[[6]](#endnote-7).

To supplement these new ministries an Industrial Reorganisation and Finance Corporation was suggested, based upon a paper produced by an industrialist B. Cant who opined that British industry was not competitive, largely due to its structure resembling too much the conglomerate and hence lacked the specialisation necessary for sustainable economies of scale[[7]](#endnote-8). This became the Industrial Reorganisation Corporation whose task was to deal with the problem that “many of the production units in this country are small in comparison with the most successful companies in international trade, whose operations are often based on a much larger market”[[8]](#endnote-9). Reporting to the DEA, and with a close working relationship to MinTech and the Board of Trade, the IRC would seek to fulfil its goals through promoting “concentration and rationalisation to promote greater efficiency and international competitiveness” and with authority to draw on up to £150m of funding[[9]](#endnote-10).

The records we use in this paper were generated by the IRC during their work and are held in the British National Archives. The files were collected primarily under the FV 44 index of files and these relate specifically to IRC activity, while the “problem with the electrical sector” is explored via the DEA record under document series EW27. Each file consists of letters, memoranda, reports and accounts relating to sectors and firms under investigation by the IRC. We can reconstruct the timeline and examine the consequence of meetings and decision making and this informs our conclusions, providing evidence for our construction of an enterprise logic supported by the IRC which did not support the product logic necessary to make these firms competitive in their chosen technologies. The next section develops a framework through which we can provide an analysis of the IRC as an organisation tasked to deliver intervention.

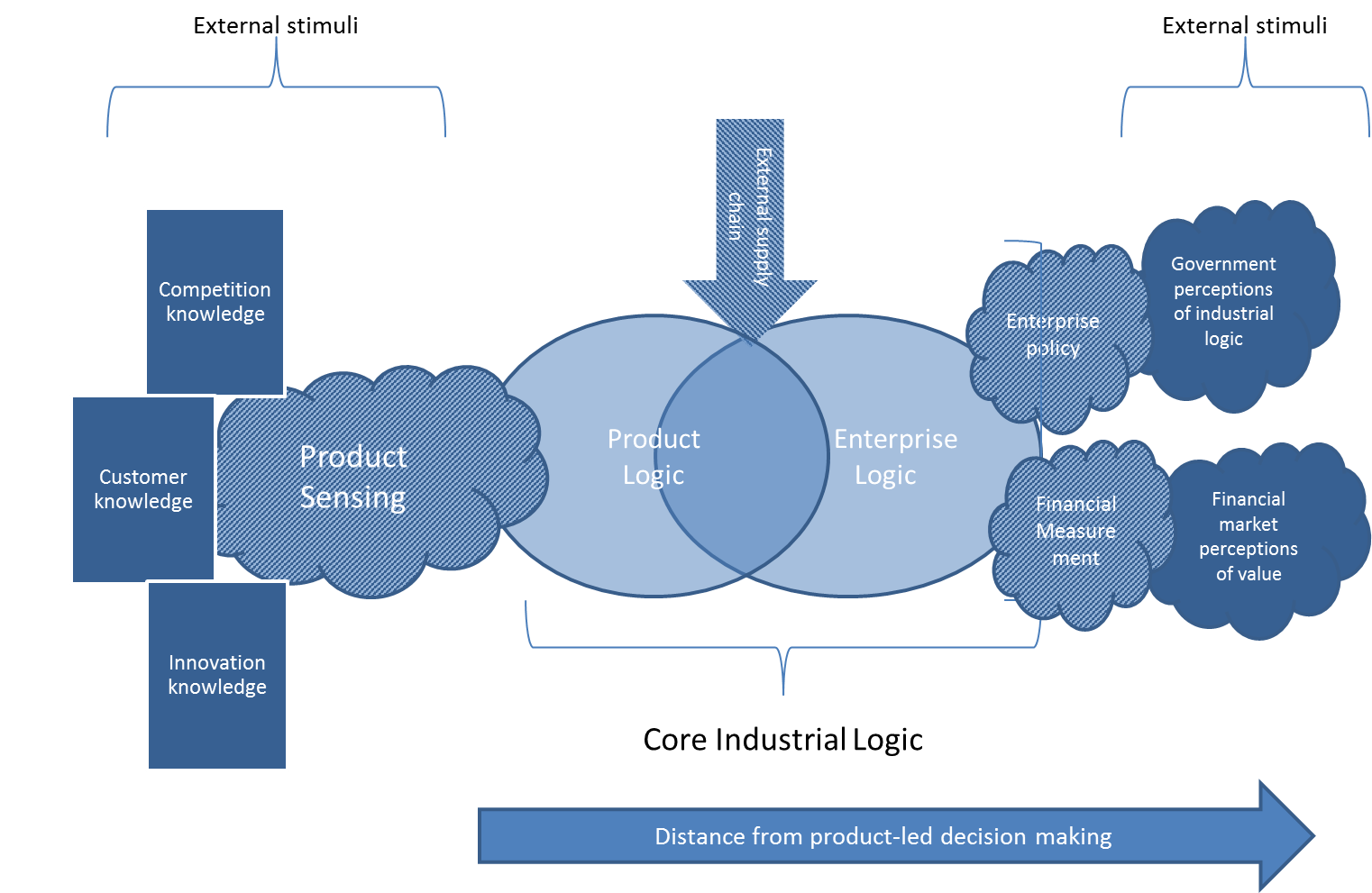
Understanding intervention: product and enterprise level logic.

In seeking to explore the nature of government intervention into business enterprise and its effect on strategy and operations, our approach defines different levels of logic and the associated knowledge/experience base encapsulated in them. Furthermore, we use the notion of contending visions used in the sense defined by Fransman as beliefs about the world and how these change and inform senior management and policymakers about which capabilities might be developed[[10]](#endnote-11). In this sense we use logic as “A particular system or codification of the principles of proof and inference” (Oxford Living Dictionary) and “Reasoning conducted or assessed according to strict principles of validity”. These definitions draw upon notions of valid inference appropriate to the circumstance and enable us to apply and build upon this idea of a technical underlying logic. We make this point to distinguish our use of the word from the more sociological institutional logic approach. Instead, the concept of interlocking enterprise and product logics helps to define the constituent elements of the industrial logic associated with any given business model. David Teece examines this explicitly in his analysis of the business model where the industrial logic is a constituent of the former. Our approach explores the logics as more fundamental units of analysis, which we can use to explore external intervention in business by government[[11]](#endnote-12). In a historical context, Chandler noted "the logic of the managerial enterprise” and that this was driven by “the dynamic logic of growth and competition that drives modern industrial capitalism”[[12]](#endnote-13). Similarly, Tomlinson notes that the merger boom of the 1960s was motivated by financial considerations rather than protectionist logic[[13]](#endnote-14). We have further developed the notion of an industrial logic by separating it out into two interlocking-levels, product and enterprise logics, that capture the knowledge and activities necessary to deliver a firm’s outputs and aid in the execution of any given strategy. We define industrial logic as consisting of:

1. Product level logic: This is the development, making and selling of the product. It is underpinned by a strong element of product understanding which helps determine the nature of the product and how it will fulfil a need and which also determines how the product should be resourced and delivered.
2. Enterprise level logic: allocation of resources and the devising of organisational structure and strategy.

Critical to these logics are the internal and external stimuli which they respond to. In the context of this paper we focus on how the intervention mechanism engages with the enterprise and consider whether interventions by government, focusing on institutional scale, swamped the product logic of the enterprises involved in the consolidations supported by the IRC and whether the IRC’s active rejection of product-logic based alternatives shaped an industry which was not focused on product-level competitive advantages.

##### Figure 1: Logics and their internal and external connections



Interfacing with product logic we see a function we refer to as product sensing which is similar to that suggested by Teece as a “sensing, seizing and reconfiguring” capability, this provides an understanding of the product and its interface with customer demand, competition and innovation[[14]](#endnote-15). The business of any enterprise is to produce a product or service which someone, somewhere, wants, and to deliver this product at an acceptable price point for the customer. Understanding what the product features should or could be, determining the nature of competitive offerings and determining the viable price in the market, is the role of product sensing and this should inform the product logic of the product divisions within the firm. This is critical to enterprises in maintaining their entrepreneurial ability to build products which customers can use, and marketing and sales teams can distribute. In effect this defines the activity in product markets whereby the enterprise might learn about demand conditions. It is our contention in this paper that the nature of IRC intervention pulled decision making towards an enterprise level, and away from an understanding of the product market. Instead, at a macro policy level the focus was purely on the benefits of scale and an assumption that institutional scale would positively affect the performance of these firms and lead to wider welfare benefits, from employment to improved balance of payments. This was to be achieved with mergers encouraging economies of scale articulated at enterprise level and associated with the carving up of product lines embedded in specific divisions and factories. These would then be shared between select groups of firms who were able to articulate a shared vision with the IRC. The intervention was based upon enterprise level understandings of capital structure and governance with a vision based upon a sector wide approach to strategy largely divorced from product demand and the capabilities required to deliver it. As we will see, the IRC rejected alternative visions based upon the product level, market capabilities offered by AEI and Plessey for reasons largely founded on an assessment of management character. This process pulled decision making away from the product sensing stimuli in effect meaning that these amalgamations ignored in large part whether the new entities would be able to deliver products that customers would want to buy. Furthermore, it is not clear that the IRC was able to conceptualise a clear vision of how increasing firm size per se would be implemented and in particular did not clearly articulate the distinction between plant and firm level economies of scale. This could only be explored in a detailed examination of product level activity shaping firm level economies of scale[[15]](#endnote-16). As will be seen, while the greatest possible scale would be achieved by creating a greatly enlarged GEC, which in the minds of policy makers was focused on a single sector, within GEC it was acknowledged the result was an amalgam of 180 medium sized enterprises lacking the single product scale promoted by AEI and Plessey[[16]](#endnote-17).

Use of the product and enterprise level logic framework focuses attention on the impact of government intervention mechanisms on the firm and its management processes. Many scholars have conceptualised the firm as a set of routines, as “a repetitive pattern of activity in an entire organisation” that “combine knowledge, particularly in the form of individual skills and organisational routines, with the sorts of inputs recognised in the economic theory of production”[[17]](#endnote-18) . An extension of this approach is Cohen & Leventhal’s concept of absorptive capacity, a process whereby a company builds an understanding of the environment in which they operate[[18]](#endnote-19). Zahra and George further conceptualize the use of this knowledge to understand not just the external environment, but the methods by which firms can build the capabilities to respond to that environment, that is what we would call the product sensing function[[19]](#endnote-20). Similarly the work of Zollo and Winter draws upon the routines/dynamic capability literature to frame how organisations learn[[20]](#endnote-21). We are asking the question what happens when policy fails to take account of the impact of re-organisation on the operational capabilities involved in product creation, that constitute learning and the processing of information about the external environment? Product sensing, as the acquisition and absorption of information about the product market place, the consumer needs, the technological environment and possibilities, and the actions of competitors, is a capability/capacity that is embedded in the factories and divisions across a firm. These capabilities are required to create a product which matches the needs of the market and which determines the internal structures necessary to produce a product which will be competitive in the external market. The importance of users to the shaping of innovation and ultimately the product strategy has been explored in the work of Eric Von Hippel and historically by JoAnne Yates in her work on computing and the insurance industry[[21]](#endnote-22). This paper builds on these insights but in the sense that intervention might destroy the capabilities required to function effectively to understand demand from users.

The IRC’s approach was flawed in our view because their vision was not based upon an understanding of the routines of product sensing and the assets needed to execute strategy and failed to engage with the capabilities developed within firms. The next section explores the background of the electronics sector before going on to examine the differing visions developed by each participant.

## The Big Three

By the end of 1968, the General Electric Company dominated the electrical engineering sector in the UK having acquired Associated Electrical Industries (AEI) and English Electric (1968). When merged, the combined work force of 228,000 and turnover of £898m made it the UK’s largest engineering enterprise[[22]](#endnote-23).

These firms had their roots in the ‘Second Industrial Revolution’, based on the production and utilisation of electricity[[23]](#endnote-24). Prior to World War Two, the UK’s “Big Three” electrical combines, AEI, EE and GEC all had historic ties with the USA’s big two firms, General Electric and Westinghouse[[24]](#endnote-25). The UK’s GEC was technologically and financially tied to America’s General Electric. AEI was the result of multiple mergers, the two biggest being the merger of Metropolitan-Vickers (Metrovick), which was aligned with Westinghouse, and British Thomson-Houston Company (BTH), strongly aligned with GE. English Electric, again a result of multiple mergers, had historically been aligned to Westinghouse.

During the Second World War, the UK’s Big Three would become less reliant on their US connections for technology or funding[[25]](#endnote-26). Indeed, the UK firms would build strengths beyond those of the US counterparts, in certain fields. In 1946, American GE, now concerned by potential anti-trust legislation in the US, sold its 40% stake in AEI[[26]](#endnote-27). AEI would purchase Siemen Brothers giving it greater capabilities in telecommunications. Meanwhile, English Electric no longer needed Westinghouse as it had established a significant R&D function in the form of the Nelson Laboratory. In 1946 English Electric bought Marconi, giving it an advanced electronics capability, and had also developed a highly successful military aircraft business, exploiting its role in aircraft “shadow factories” during the war. Post-war, English Electric produced the successful Canberra bomber and the Lightning fighter. It would also build one of the UK’s leading computer businesses. GEC’s most important move was the acquisition of the television manufacturer Radio and Allied Industries in 1960, which brought not only television capacity into GEC, but also a young executive, Arnold Weinstock. Within three years he was the managing director of GEC itself and introducing strict financial management to the company.

##### Table 1: Performance of the Big Three 1960-1967

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 1960 | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 | 1967 |
| Turnover £millions | | | | | | | | |
| AEI | 215.0 | 213.7 | 210.2 | 212.7 | 236.6 | 254.5 | 264.7 | 259.6 |
| GEC | 116.9 | 118.6 | 135.2 | 146.5 | 158.1 | 170.1 | 168.7 | 180.0 |
| EE | 165.1 | 194.4 | 199.7 | 209.0 | 227.3 | 244.8 | 291.4 | 411.6\* |
| Profit before tax £millions | | | | | | | | |
| AEI |  | 9.8 | 11.5 | 8.7 | 13.9 | 16.5 | 13.1 | 8.4 |
| GEC | 5.9 | 5.2 | 6.4 | 8.0 | 13.0 | 18.6 | 20.7 | 18.9 |
| EE | 7.8 | 6.1 | 7.9 | 11.8 | 14.6 | 17.9 | 22.5 | 29.3 |
| Profit as a % of capital employed | | | | | | | | |
| AEI |  |  | 6.6 | 5.1 | 7.9 | 8.1 | 6.1 | 4.4 |
| GEC | 6.8 | 5.3 | 6.0 | 7.8 | 12.7 | 17.4 | 18.7 | 16.5 |
| EE |  |  | 8.5 | 11.6 | 12.3 | 14.0 | 13.5 | 11.9 |

\* Includes Elliott Automation

Source: Bank of England, 6A233/2, Economic Intelligence Department, Industry Group 1972

However, while the Big 3 represented the largest firms in the sector, there were a myriad of smaller enterprises, some in established businesses making heavy electrical equipment and still others in the forefront of electronics innovation. The IRC’s decision to support rationalisation in this sector came from both its charter to reorganise and rationalise British industry and from specific concerns held by its controlling ministry. In January 1967, the DEA prepared a note aimed at targeting the Heavy Electrical Sector for rationalisation[[27]](#endnote-28). This report listed a number of “apparent weaknesses” in the electrical sector, the key focus of which were perceptions of low productivity and too many enterprises.

The sector was seen as lagging in terms of increased output per head; from 1958 to 1963 MLH 631 (the SIC sub-sector covering switch gear, electric motors, transformers etc.) had seen net output per head increase by 8% but that was poor compared to the 29% achieved for the whole of the SIC order IV (engineering and electrical goods). Further, the ratio of US to UK net output per worker was estimated to be 3:1. One of the root causes was supposed to be high levels of fragmentation in the industry, for example in the transformers sector the report counted 15 Power/High Voltage Transformer manufactures and 40 – 50 Distribution Transformer manufacturers[[28]](#endnote-29). Further, the market for electrical equipment was likely to diminish as spending on upgrading the National Grid and Regional Board distribution networks coming to an end and it was expected that the Central Electricity Generating Board would slash spending on electrical equipment.

The DEA foresaw two ways of consolidating the sector[[29]](#endnote-30), the first, and preferred option, was to rationalise by creating consolidated businesses with a focus on discrete sectors/products. However, with so many products and firms this approach was seen as complex and it would take a long time to move products between companies to create the new businesses with individual product sector focuses[[30]](#endnote-31). The alternative approach was to rationalise at firm level, bringing whole companies together rather than realigning individual product sets across enterprises. However, the DEA considered this latter approach would “perpetuate the diversification of certain firms which is one of the unsatisfactory features of the industry”[[31]](#endnote-32). The DEA preferred a sector/product level realignment as the individual manufacturing units in each firm were too small to support the required R&D overhead, to be efficient or competitive internationally. As will be seen in this paper, it was the firm-level rationalisation, instigated by and preferred by the IRC, which was to have the greatest impact.

### GEC’s contested acquisition of AEI 1967

The IRC, acting on the mandate it had from the DEA to reorganise the electrical sector, was quickly interested in encouraging GEC to take over the running of the seemingly ailing AEI. GEC was seen as the success story of the sector and there was evidence for this opinion. In 1966, AEI had a turnover 50% greater than GEC’s. However, in terms of profitability, it was GEC which was beginning to perform well, as indicated in Table 1 above. In 1962/3, GEC had a return on capital of 8.5% which the new management, led by Arnold Weinstock, had increased dramatically, achieving 20.9% in 1967/8 (a year where AEI and GEC reported separately, though AEI had by then been acquired). Meanwhile, in the same period, AEI’s return on capital had declined from 6.5% to 6%[[32]](#endnote-33).

On 13th October 1967 GEC formally announced to the press and to AEI shareholders an offer to buy AEI with the full backing of the IRC[[33]](#endnote-34). However, most notably, it was not GEC which initiated the process of acquisition; this take-over was based on a unilateral initiative by the IRC. The logic of the IRC approach and the GEC takeover was strongly challenged by AEI which had developed a different concept for its future based on a realignment of products which would lead it to focus on high technology telecommunications.

For the IRC, the key factor was Arnold Weinstock, the young financially-literate leader of GEC. It was directly stated “GEC has Weinstock”[[34]](#endnote-35) and this appears to have been a powerful argument to the IRC as his vision was based upon the enterprise level language of corporate organisation and financial control. Ronald Grierson, managing director of the IRC, approached Weinstock, indicating that it would support a bid for AEI and could provide funding to help it happen. Weinstock wrote to Grierson immediately stating “Your talk the other day has been making us think at a furious rate. Although we are reluctant to contemplate the task you suggest we should undertake, it must be admitted that, from a national point of view, the possibilities which such a move would create would be very far reaching”[[35]](#endnote-36). Weinstock noted that to achieve these goals “we need a good deal of help and understanding to cope with the horrors which would face us”[[36]](#endnote-37).

On 26th September, there was a rise in AEI’s share price and speculation that American GE was interested in bidding for the company[[37]](#endnote-38). However, AEI was to be taken aback when an arranged visit to them by Kenneth Keith of Hill Samuel was not to discuss general reorganisation of the sector on behalf of the IRC but instead he wanted to discuss GEC’s impending bid for AEI[[38]](#endnote-39). In fact, Hill Samuel, had initially been paid to undertake preliminary work on a takeover of AEI by GEC on behalf of the IRC, but had since been taken on as GEC’s merchant bank to execute this plan. Hill Samuel informed AEI and the market that the bid had the full support of the IRC, The Board of Trade and MinTech[[39]](#endnote-40). Senior management at AEI felt railroaded into such a transaction especially as they had their own vison for the industry and their role in it.

#### The AEI-STC product-based alternative

On 20th October 1967 AEI formally wrote to its shareholders noting three key product-based issues[[40]](#endnote-41). Firstly, it noted that its major investments, especially in telecommunications, were likely to generate significant increases in shareholder returns. Secondly, it noted that under the offer from GEC it would be GEC shareholders who would disproportionately benefit from these investments and in the improved performance of AEI. Thirdly, it rejected claims it had not supported the reorganisation and restructuring of the electrical business, noting it had created a joint domestic appliances company consolidating EMI’s and AEI’s businesses into British Domestic Appliances, and that it had acquired cable, transformer and electric motor operations to increase AEI’s scale in these businesses.

Furthermore, AEI announced three new initiatives to deliver rationalisation in the sector. At a future date they proposed to merge the turbines and generators businesses of AEI with English Electric to form a large power generation division. Further, they noted that they already had a well-developed proposal to merge the transformer businesses of AEI, CA Parsons and GEC itself.

At the heart of its alternate vision was a desire to focus on the area of telecommunications. AEI had invested heavily in new electronic exchanges, primarily at its large Woolwich site and it proposed to pool this business with the business of Standard Telephone and Cables (STC), the UK subsidiary of US telecommunications group ITT[[41]](#endnote-42). Their product vision was to focus on newer and lighter technologies primarily in telecommunications and to maintain a leading position in its cable business (important to telecommunications) in combination with the similarly aligned STC. Given this plan it was willing to cede control of heavy equipment operations to other firms. This represented an alternative vision that was at least as viable as the one offered by the IRC. Indeed, the AEI-STC plan did more in terms of the product/sector rationalisation which the DEA had once shown preference for, holding out the prospect of forming three large entities, one focused on telecommunications, one focused on turbines, generators and electricity generation and one focused on transformers. In the IRC’s vision, integrating AEI and GEC would instead create the largest single enterprise in the sector (just larger than English Electric), but one which stretched across most of its individual sub-sectors of the electrical and electronics industry.

Telecommunications was one of the areas of overlap between GEC and AEI. In a document prepared for the Mergers Panel it was estimated that in public telephone exchange and transmission sales, AEI had turnover of £12m and GEC £16.8m. In addition, both firms provided user telephones to the GPO under a bulk agreement (in which 5 companies took part), winning about 10% of the market each (roughly £1m each a year)[[42]](#endnote-43). Together, they would have about 38% of the GPO market for exchange and transmission equipment. The IRC and MinTech believed GEC to be stronger in this business, especially in transmission equipment. However, The IRC analysis ignored the fact that AEI was dominant in the UK cable market, giving AEI overall a larger stake in telecommunications markets. In addition, AEI, like STC and Plessey, were highly focused on the more technology-intensive exchange market and it was here that AEI saw advantage in combining its electronic exchanges with STC[[43]](#endnote-44) and its strength in crossbar exchange technology[[44]](#endnote-45). GEC did make exchanges, but these were licensed technology from Plessey.

AEI’s view was that “there must be measures of rationalisation if the British electrical industry is to be sufficiently strong and profitable…[but] that to attempt to cover the whole of the field in such a diverse industry is not sound policy because this dissipates effort and tends to lead to weakness rather than to strength”[[45]](#endnote-46). Further, AEI told shareholders “Your Board confirms its strong recommendation that you should reject the takeover bid from GEC… A merger of this kind is largely irrelevant to the requirements of the industry”[[46]](#endnote-47). AEI had formulated a product-based case, one that reflected a more nuanced reading of the industry rather than relying on pure economies of scale at an industry level.

On 23rd October, the IRC board met to discuss the GEC-AEI merger and specifically to examine a request by AEI for the IRC to support its alternative approach, involving smaller reorganisations of the telecommunications, generator and transformation businesses[[47]](#endnote-48). The board was told that these proposals represented only 20-25% of AEI’s business. While stating it was neutral, the board made clear it supported the wider GEC-AEI solution. On 2nd November 1967, the IRC sent a briefing document to the Minister of Technology which stated that, while there were specialist firms in the international market such as LM Ericsson in telecommunications and Brown Boveri in generation sets, the main competition was now from large companies able to support larger contracts and which deployed massive resources, such as GE, Westinghouse, Siemens, Phillips, AEG and NEC.

MinTech would intervene to support the IRC viewpoint, and this was confirmed at a meeting held on the 2nd November, between the Minister of Technology, the deputy and vice chairman of AEI and the managing director of STC[[48]](#endnote-49). The function of this meeting was to express disapproval of the STC tie-up, specifically because the ministry was concerned about them being owned by the US specialist ITT[[49]](#endnote-50). Simultaneously, GEC increased its offer to 73s.6d a share, in the form of GEC shares, which gave AEI shareholders 40% of the new combined stock[[50]](#endnote-51) and was a price accepted by AEI shareholders[[51]](#endnote-52).

Direct IRC financial support for the deal was not needed. However, the IRC found another way of providing immediate funds by obtaining payment that had been held back because of poor performance. The Hunterston nuclear power station used two of GEC’s Magnox reactors but, payments had been withheld over the performance and delivery of these reactors. The Chairman of the IRC arranged for the payment of £7m to GEC by the Scottish Electricity Board (SEB) which had commissioned the station; in return the IRC provided a guarantee of £250,000 to cover any extra remedial costs which the SEB may need to pay for to get the reactors working to specification. This guarantee protected the SEB from some of the costs associated with further over runs of the Magnox reactors, and brought forward £7m of funding to GEC without any cost to the IRC (assuming no payments were needed for resolution of problems) and sparing GEC the cost of going to financial markets to access further funding for the acquisition of AEI[[52]](#endnote-53). This smoothed the passage of the transaction.

The IRC played a further essential role in circumventing governmental barriers by working toward ensuring the bid was not referred to the Monopolies Commission[[53]](#endnote-54). On 5th October 1967, Brooke of the IRC wrote to the Board of Trade, with the support of both MinTech and the DEA, outlining and summarising the position of the IRC in supporting the merger[[54]](#endnote-55). On 18th October, the IRC’s Grierson met with Richard Powell of the Board of Trade who confirmed they had decided not to refer it to the Monopolies Commission subject to minor alterations[[55]](#endnote-56).

### GEC’s contested acquisition of English Electric, 1968

In 1964, George Nelson, 2nd Baron Nelson of Stafford, who had replaced his father as the Chairman of English Electric and retained the role of chief executive, spoke at the London School of Economics in their 'Seminars on the problems in industrial administration'[[56]](#endnote-57). He benchmarked English Electric against its UK and international rivals, setting a standard of 17.5% return on capital to be competitive. He spoke at a time when English Electric were in the ascendant, characterising the period as having no shortage of orders, only shortage of capacity to fulfil them. However, by the time of the 1967 annual report, the situation was different; in 1966/67, return on capital had declined to less than 10%[[57]](#endnote-58).

English Electric had a number of ongoing problems. It had failed to grow its stake in the computer industry with the ill-fated System 4, a range of computers designed to emulate IBM’s dominant System/360 family, but which was both a product failure and a financial burden[[58]](#endnote-59). In 1968, this division would be integrated into the newly formed UK computer champion International Computers Ltd (ICL), but it still weighed on English Electric’s accounts as it had retained a stake in the company. Further, in mid-1967, the IRC had engineered a takeover by English Electric of Elliott Automation which had run into financial difficulties as a result of developing a number of major projects at the same time. The merger of Elliotts with English Electric’s Marconi division gave the latter an electronics business with a £150m turnover. The IRC provided £15m of funding to support the takeover “towards assisting the development of the electronic activities of the Electronic Group” into which Elliotts would be placed[[59]](#endnote-60). Again, the important role of the IRC was as much to prevent government interference in the merger and following IRC recommendations the Board of Trade informed the press that it and MinTech supported the merger and no referral to the Monopolies Commission would be made[[60]](#endnote-61).

However, the IRC and English Electric had not considered the problem of integrating a financially-strained Elliott into EE’s existent electronics operation, Marconi - indeed existing problems had been ignored. Six months after the takeover an IRC team went to the main Marconi centre in Chelmsford, Essex and reviewed the management and performance of the division. This review of Marconi concluded that it “suffers from rotten management”[[61]](#endnote-62). It was becoming clear that the integration of Elliott Automation was more difficult than originally envisaged and the 1967 English Electric annual report described the results from the joint divisions as disappointing even compared to the offer document written only a few months earlier[[62]](#endnote-63). The IRC began to doubt the wisdom of supporting the operation with its current management and noted the “matter has already been briefly mentioned to Mr Weinstock”[[63]](#endnote-64). It was against this background that Plessey made a bid for English Electric.

#### Plessey and English Electric

On 21st August 1968, Plessey formally bid for the weakened English Electric[[64]](#endnote-65) and officials from MinTech and the IRC met to discuss the implications[[65]](#endnote-66). The IRC was concerned over the implications for its program to rationalise the electrical/electronics sector especially as it had invested in the takeover of Elliotts by English Electric. In addition, MinTech had brokered and invested in the merger which created ICL, a firm in which MinTech owned a stake, along with English Electric.

Warburg and Plessey made a case for the merger in terms which would support the aims of the IRC, but challenged the latter’s interpretation of the industry and its technological future. Plessey emphasised that the combined company would have a turnover of £580m which would put it in “the world league”, slightly larger than AEG in Germany and matching the size of Hitachi in Japan, though much smaller than some other rivals such as Siemens, Phillips, ITT, Westinghouse and only a sixth of the scale of GE[[66]](#endnote-67). They noted that £140m of English Electric’s turnover was in communications and automation as was 80% of Plessey’s £170m turnover. However, their emphasis was not simply on joint economies of scale opportunities, but also the complementarities in their product lines[[67]](#endnote-68). The merged company would offer all forms of communications from telephone exchanges (Plessey’s strength) to microwave, transmission and space communications (Elliott and Marconi strengths) and through integrating these product lines could better match the capabilities of ITT and Siemens[[68]](#endnote-69).

However, the IRC and MinTech viewed a Plessey-English Electric merger as offering nothing toward the consolidation and rationalisation of the heavy electrical equipment sector. For the IRC, Plessey “has little relevance and the comparison as partners for English Electric must be made between GEC and Hawker Siddeley[[69]](#endnote-70). For them it was the large scale electrical company GEC which made the natural partner for English Electric or, alternatively, Hawker Siddeley which had a transformer and switchgear business of smaller scale. In addition, a merger of English Electric and Hawker also held out the prospect of a creating a merger of BAC (in which English Electric held a 40% stake) with the Hawker aviation assets creating a single UK aircraft company. Government policy was supportive of a single aircraft manufacturer, merging Hawker and BAC, but was not at the time actively pursuing the project[[70]](#endnote-71). The problem for the IRC was that Plessey was offering a generous valuation on English Electric at £285.2m and a healthy price to earnings ratio of 25.5%, making the offer attractive[[71]](#endnote-72).

As the IRC were aware, Plessey had been in ongoing but informal discussion with Hawker Siddeley about what it would do with the heavy electrical side of English Electric. Plessey made it clear they were willing, indeed keen, to offer Hawker Siddeley English Electric’s engine and heavy electrical businesses and English Electric’s stake in BAC if their bid was successful[[72]](#endnote-73). An IRC team visited Sir Arnold Hall, Managing Director and Chairman of Hawker Siddeley[[73]](#endnote-74), where the informal agreement between Plessey and Hawker was confirmed to the IRC. This would allow a realignment of the telecommunications, electronics, heavy electrical, and aircraft sectors, while allowing Plessey to focus on its product alignment with the elements of English Electric (primarily Elliott and Marconi) which it did want. However, from the IRC’s view point they calculated GEC had a 70% product overlap with English Electric and thus naturally offered more potential efficiency gains.

#### Weinstock not Clark

The IRC conducted a number of meetings with Plessey to understand their bid. On August 22nd, the day after the formal bid the IRC met with John Clark, Chief Executive and one of the controlling brothers of Plessey Lord Harding, the Chair, together with Plessey’s adviser, Henry Grunfeld from Warburg[[74]](#endnote-75). It was suggested that 30% of English Electric fitted within Plessey, adding such abilities as radio, space communications and, above all, industrial computers which could be used to control the radar, aerospace and telecommunications systems in which Plessey specialised. The IRC would also meet with senior operational staff from Plessey, though these were not judged a success by the IRC[[75]](#endnote-76). Managing Directors of Plessey’s operational groups made the case that Elliott and Marconi capabilities would fit well with the firm. Michael Clark, Deputy MD of Plessey (brother of John Clark) and BF Willets, MD of the telecommunications group, emphasised that its successful telephone exchanges business had nevertheless been handicapped by its inability to deliver microwave and transmission equipment and meant that it had lost business. Marconi could provide this sort of equipment.

The IRC expressed enthusiasm for the capabilities of some of the operating group directors at Plessey, especially those at the Dynamics Group, Electronics Group and the Regional Director of America (who happened to be available); they were less than enthusiastic about their meeting with W.R.R. Haines, Director of Corporate Planning and Hudson (no initials give), the Director in charge of Planning and Finance[[76]](#endnote-77). These Plessey senior managers emphasised that they believed in a small but powerful central function for planning. The firm had a central planning staff of five who in turn worked with 20 planners operating within the operating businesses of the firm and together they developed group-level product planning and avoided the problem “of ‘back-room’ planners hatching crazy schemes remote from the profit centre”[[77]](#endnote-78). This was very different to GEC’s rejection of having a central function outside of finance. The planners set a growth target of 15% for Plessey’s businesses, though telecommunications, the largest unit, was increasing at only 12.5%. Importantly, the staff and planning team played an important function running what they called a product audit, which looked at the lifecycle and the interconnections/mutual support that products could provide within the group. It was assumed that the product lifecycle was only 5-7 years, meaning that new products and associated enhancements had to be developed at a rapid pace – again this was far from Weinstock’s disaggregated systems where the planning focus was based on financial returns and products, with little central coordination. At Plessey financial control was maintained by a central staff where 20 per cent were accountants.

The IRC rejected both the leadership of this function and indeed the function itself. Their opinion was:

“The disappointment in our discussions with Haines was Haines himself. He offered none of the imaginative broad sweep about Plessey in relation to its environment now and in the 1970’s; he was more concerned to drag us into obscure detail about techniques of defining the problems”*[[78]](#endnote-79)*.

They opined that it was the function of the main board to make strategy and that planners should only evaluate problems and aspects of feasibility. It seems remarkable that planners operating mainly in the operating units of complex, high technology business units would be so dismissed. It is notable that in the rapidly advancing computer sector, the dominant leader IBM was actively dismissing the idea that generalist management could contribute to the planning of high technology businesses such as computer products[[79]](#endnote-80). However, Plessey’s articulation of changing technology and market demand was rejected more or less out of hand by the IRC.

What is perhaps more extraordinary is that Knight, of the IRC, noted that meetings with the firms and site visits, were not crucial “to our decision to support GEC” as the decision was based on wider “information and broader aspects of structure and top management”[[80]](#endnote-81). Not only were they were rejecting the notion of the product logic underpinning the enterprise, they were not even interested in listening to it.

Fundamentally, the IRC had greater faith in GEC’s Arnold Weinstock. At the very first meeting with MinTech to discuss the merger, the IRC representatives noted while the “IRC do not have detailed knowledge of the Plessey Management…[the] impression was that of a tightly managed company”, however, they concluded that “Weinstock and his GEC team could probably do a better job of improving English Electric”[[81]](#endnote-82). For the IRC, the issue was the leading characters, “the basic difference between Plessey and GEC is the difference between Weinstock and John Clark. Having regard to the respective abilities and personalities of the two men, there must be a doubt whether John Clark can match Weinstock”[[82]](#endnote-83). Evidence was presented to this effect including reporting that Jules Thorn, whose company Thorn [a major lighting and white goods manufacturer] was an important customer of Plessey components, was reported as believing that having “known both the Clark brothers [who controlled Plessey] for many years as a result of a close acquaintance with their father [had] indicated informally his disapproval of the [Plessey] bid”[[83]](#endnote-84).

However, the report summing up Thorn’s view, which was circulated to the senior management and later to the board of the IRC, was very different in draft form. A large segment had been removed from the final section. In the draft it was reported that Jules Thorn held “profound antagonism towards Weinstock and has a capacity for making mischief which would require watching if IRC supports GEC [in taking over English Electric]”[[84]](#endnote-85). In another meeting with Thorn, it was noted he made “numerous aspersions cast in this connection on Weinstock, who has yet in Sir Jules’ view to prove himself”[[85]](#endnote-86), but the report writer noted he would actively “leave out” these aspersions. One key reason Thorn was antagonistic to Weinstock was his belief that GEC was preventing, not promoting, rationalisation in sectors they were concerned with. Thorn owned a 50% stake in Thorn-AEI Radio Valves and Tubes and had management control over the operation. Thorn wanted full control but Weinstock refused collaboration. The IRC files reported that Thorn was “obviously dying to raise as much hell as possible”[[86]](#endnote-87) and had already raised questions about a monopolies and merger investigation.

Lord Nelson of English Electric was deeply unimpressed by the Plessey offer, though financially it was substantial. For him they had “no knowledge of, or experience in” heavy electrical and saw no compatibility in the lighter electronic business[[87]](#endnote-88). The only strength Plessey had in his opinion, other than telecommunications, was microcircuits where he acknowledged Plessey had the best technology but little production. Confident enough that the IRC would support a white-knight bid, the English Electric board made a formal announcement rejecting Plessey and announcing that the IRC were reviewing the sector[[88]](#endnote-89).

Weinstock’s main concern in making a counter offer was that a merged GEC-EE would be “disproportionately large and, on this account, there would be a real possibility of reference to the Monopolies Commission”[[89]](#endnote-90). He thought any recommendation to the Monopolies Commission was fundamentally down to the IRC and pointed out that in international terms “GEC + EE would not be disproportionately large”. On August 30th, Weinstock formally wrote to Sir Frank Kearton of the IRC making clear the lack of sense in a Plessey takeover of English Electric, but the logic of a GEC takeover, given the much greater overlap and thus the opportunity to rationalise[[90]](#endnote-91).

By 2nd September, the staff of the IRC had formally decided to support a GEC takeover of English Electric. This was awkward in that they had not finished their fact finding. Indeed, on the day of the final meeting with Plessey (the 3rd September) formal briefing papers for Ministers were prepared outlining the support for GEC taking over English Electric “Ministers will be attracted by most of the political and industrial aspects of this alternative and concerned by only one factor – the “market power” of the company”[[91]](#endnote-92). They believed both Plessey and Thorn could push for a referral to the Monopolies Commission but would work to prevent the companies intervening and argued that the potential for a 10% IRC stake in the merged company and having an IRC representative on the merged company’s board (neither of which would happen) as being in the public interest.

On 6th September, English Electric and GEC formally announced their intention to merge, with English Electric’s Lord Nelson as Chair of the integrated company and Arnold Weinstock as Managing Director[[92]](#endnote-93). Under IRC recommendation, the Board of Trade would not to refer this massive reorganisation of British industry to the Monopolies Commission[[93]](#endnote-94). Any counter action by Plessey, described as a potential “fairly heavy broadside”, would be mitigated by MinTech, given its position as a key customer of Plessey and which supported the IRC position[[94]](#endnote-95). The need for an IRC stake in the combined GEC English Electric was not taken up and negotiation began in November to arrange the repayment of the IRC loan given to support the purchase of Elliott Automation[[95]](#endnote-96). On 15th November, Plessey announced that they would not be making a counter offer[[96]](#endnote-97).

### Post-merger outcomes

It is worthwhile considering the restructuring process undertaken at GEC following the English Electric merger. The first action taken by Weinstock was to end all intra-group planning organisations in favour of creating separate profit centres which were controlled by a small central financial function at its small head office in Stanhope Gate[[97]](#endnote-98). All subsidiary boards and intra-company standing committees were closed and all managing directors of the operating businesses became directly accountable to Weinstock. The company memo from Weinstock to his managers on the one hand offered them autonomy but expressed concern over wasted effort and wasted monies inside the group[[98]](#endnote-99).

Of more direct concern to government was the prospect for large scale job losses. GEC was now a very large company employing 230,000 people. Within the group, there were 9 businesses inside the merged AEI/EE/GEC companies where there was little overlap. However, there were 13 large businesses across the AEI/EE/GEC merger in which there was substantial overlap and clearly major rationalisation and redundancies could be expected[[99]](#endnote-100). What is notable is that restructuring would not be based on the strengths of individual sites, but rather their location. It was noted by the IRC that, in the case of rationalising the transformer business:

[Weinstock] “is very sensitive indeed about how to deal with redundancies and the particular problem of redundancies in areas of high employment, thus when it comes to rationalisation of transformers he will probably have to close the London operation even though it is the most efficient since the other operations are in high unemployment areas”[[100]](#endnote-101).

This same reasoning had earlier led to the planned closing of the Woolwich telephone exchange systems operation of AEI, even after significant recent modernisation. Compliance with regional policy was put ahead of any product logic or sense of where capabilities lay.

Even more problematic for the National Plan was the problem of exporting. In January 1969, Michael Montague of the British National Export council was contacted by both the Chairman of the British Chamber of Commerce in Japan and the Embassy Commercial Counsellor in Tokyo noting that GEC had decided to close English Electric’s export office in Japan[[101]](#endnote-102). Weinstock was accused of a “vendetta” against operations in Japan and that it was a short-sighted decision to locate sales operations in Hong Kong as this would end all export and cooperation opportunities with Japan at a time when their electrical and electronics industry were beginning to make significant inroads into a variety of markets[[102]](#endnote-103). The Board of Trade began to be conscious of previous warnings that GEC was the wrong choice from an export viewpoint were well founded. In an internal memo it was noted “at the time that the English Electric merger was first mooted after the Plessey bid, I recorded a note of a warning of the effect this might have on exports. This was because AEI and English Electric had been very active in the export field and GEC…had not.[[103]](#endnote-104)” In one meeting with an ambassador, Weinstock was quoted as saying “my company is interested in profits, Mr Ambassador, not exports”[[104]](#endnote-105). It was noted that Weinstock had started to veto export orders, even substantial ones such as a $12m telecoms exports order from Central America because he believed the margin was too small. He also planned to reduce sales organisations including in the USA, which had been a target market for English Electric. One GEC manager noted that under their autonomous system, GEC was effectively 180 medium-sized companies, none of which would export unless they could show in their figures that the margin was up to Weinstock’s requirements[[105]](#endnote-106).

The President of the Board of Trade, Anthony Crosland, on seeing minutes of the conversation between the BoT and Michael Montague of the Foreign and Commonwealth Office’s British National Export Council covering the closure in Japan, made this remarkable internal statement “If it is true that GEC’s export performance is likely to decline substantially, Mr Weinstock and his colleagues consistently lied to us when they put the case for the merger with English Electric”[[106]](#endnote-107).

## Conclusion – the IRC and its focus on enterprise logic

In this paper, we have explored an important sector which was reorganised using a justification based on enterprise logic, where scale and scope arguments prevailed over product logic-based arguments. Furthermore, this reorganisation represented “planning from above” conducted by organisations such as the IRC and MinTech which negatively impacted on the routines and capabilities of the entities being restructured, and how they related to performance in product markets.

We recognise that there are conglomerate enterprises which de facto place greater emphasis on the enterprise logic of their complex structure and that there are external forces which pull decision making away from the product sensing informed product logic which underpins decision making. Financialisation can be seen as one such paradigm, where the enterprise has to establish policies to satisfy the demand for returns determined by financial market requirements rather than productive success.

At every stage of the rationalisation process which took place in the electrical sector, the logic was that consolidation would lead to bigger business unit who would be more efficient, more competitive and would thus compete better on the world stage. The product was of little importance and indeed arguments based on improving product sets were rejected. In the case of AEI, it aspired to create a high technology telecommunications group through a merger or close partnership with STC and planned to dispose of its heavy electrical operations to help rationalisation elsewhere, but the IRC supported the aggressive takeover by GEC as it would lead to wider rationalisation. Indeed, the IRC seemed to rely on a concept where sectorial similarity could lead to economies, yet rejected product level plans to create alignments which could have led to operational and product improvements. The effect was that, while it seemed GEC was not a conglomerate, organisationally there was little effort to exploit synergies.

The IRC rejected Plessey’s aspirations to acquire English Electric so it could combine and improve the product range of the two companies across communications and other electronics fields through mutually enhancing product sets. Despite Plessey’s desire to sell the heavy electrical and aerospace interests of English Electric to Hawker Siddeley, the IRC instead preferred a perceived ‘quick fix’ of the 70% synergy between English Electric and GEC, creating a firm with many smaller independent operations and little interest in exports.

This paper suggests that the impact of this particular 1960’s industrial intervention was to focus on organisational restructuring predicated on the importance of scale no matter what its foundation and a rejection of product-based arguments. Our analysis differs from previous interpretations because we have used archival evidence that has only recently been released from the IRC itself. These reveal the IRCs enterprise-level logic, based upon visions from charismatic senior managers prevailed over the alternative product-led plans for AEI and English Electric presented by AEI, Plessey and supported by the likes of Hawker Siddeley. Indeed, the IRC directly rejected any interest in products in favour of assumptions that sheer scale at plant or firm level led to efficiency. Their reaction to the head of planning at Plessey “dragging” them into discussing product details, in the context of the general language of the files, was dismissive. The broad sweep of Weinstock was accepted as the vision of the IRC and “GEC has Weinstock” was a key reason for rejecting alternative enterprise alignments. However, it must be remembered it was the IRC which commissioned merchant bank Hill Samuel to prepare a GEC bid for AEI, but what they had found in Weinstock was a willing agent for completing enterprise-level consolidation.

The recently declassified files covering the IRC reveal the impact of their intervention on the electrical and electronics sector. What we observe from the archive is the process whereby the IRC rejected product-based alternative visions submitted by Plessey and AEI. These had the potential to produce specific economies of scale within product sets rather than focusing on pure enterprise scale. The DEA papers state that they had a preferred option to rationalise along product lines and we can now see through the archives how aligned the alternative plans were to a product-logic view of consolidation. Nevertheless, the archive shows that the IRC initiated the GEC takeover of AEI (funding initial merchant bank activity before GEC had considered such a merger) and shows the process by which it brought in other government bodies to support its rejection of AEI’s desire to merge telecommunications activities with STC and consolidate heavy electrical operations with Parsons and others. We also can now see that the IRC rejected Plessey’s product realignment case even before it even met with their strategy group to discuss the foundations of the proposal and the IRC’s out of hand rejection of Plessey’s product-planning approach.

Through the archival material we see that the IRC was quickly aware that its actions had exacerbated the problem of “haphazard” large companies - the very concern highlighted by the DEA and in the white paper which established the IRC[[107]](#endnote-108). The IRC is clearly told by a GEC insider that the post-amalgamation firm was 180 medium sized enterprises with limited individual economies of scale. Furthermore, in the immediate aftermath of the merger we see the reaction to Weinstocks closure of English Electric’s export office in Japan with Crossland accusing GEC and Weinstock of lying; the reality was, however, that in firm with 180 small operating units and which was to be run on strict accounting lines, there was no central organisation willing to support shared export offices. The IRC rejected Plessey’s vision of product alignment and central planning and GEC’s post-merger structure reflects this; enterprise scale not operational scale.

Taking the company merger route was an enterprise logic approach to strategic consolidation. The DEA had already foreseen that such an approach would perpetuate the diversification of the electrical/electronics industry. This failed to match both the National Plan and the DEA’s desire for rationalisation within product lines to promote efficiency and boost competitiveness. Plessey’s focus was on consolidating product sets and combining capabilities to create products customers wanted. The Plessey approach was rejected by the IRC which saw enterprise-level consolidation as the only way of creating enterprises as large as some of the international competition. This approach led to other variances from the aims of the National Plan and the DEA, as Weinstock’s enlarged GEC was quick to shut down major export operations and offices. Furthermore, this paper shows the way Weinstock ended all central planning, including cross-divisional product planning, at the merged GEC-English Electric, and a system of financial controls imposed on many self-determining businesses. The ultimate effect was for government policy to ignore consumer demand and hence compromised future success of the business in markets.

Other scholars have noted a similar approach by the earlier Conservative government of 1959-1964 sought to restructure the aircraft sector and its enterprises. The Ministry of Aviation believed larger development teams were needed to properly engineer increasingly complex supersonic performance aircraft. In 1959, Duncan Sandys was placed in charge of the newly created Ministry of Aviation. Sandys’ goal was to reorganise the sector into two large integrated companies, using the government’s control over both military and civil aircraft contracts. The latter was possible because the two main UK airlines were state controlled. In the context of this paper, the key issue in the reorganisation of the aircraft sector was the precedent it set - structure was more important than product considerations. It was boldly stated: “Anybody left outside the groups would be [in] a poor place to receive support even if their product was better”[[108]](#endnote-109).

Government-supported mergers not only took place in the electronics and electrical sector. The earlier creation of the British Aircraft Corporation, the contemporaneous creation of British Leyland in the automobile sector, ICL in the computer industry and the later creation of British Ship Builders and British Aerospace being a few of many examples. Further research will explore whether such mergers were soundly based on product level rather than a more top-down enterprise level perspective, divorced from the realities of product markets and consumer demand.

## References

Carnevali, F. (2005). *Europe's advantage: banks and small firms in Britain, France, Germany, and Italy since 1918.* Oxford: Oxford University Press.

Chandler, A. D. (1990a). The Enduring Logic of Industrial Success. *Harvard Business Review*, 68(2), 130-140.

M Chick (2002) *Industrial Policy in Britain 1945-1951: Economic Planning, Nationalisation and the Labour Governments*, Oxford, Oxford University Press.

Cohen, W. M., & Levinthal, D. A. (1989). “Innovation and learning: the two faces of R & D”. *The Economic Journal*, 99(397): 569-596

Crafts N & A. Hughes (2013) *Industrial Policy for the medium to long-term.* Future of Manufacturing Project, Evidence Paper 37

Edgerton, D. (1996). “The'White Heat' revisited: the British government and technology in the 1960’s”. *Twentieth Century British History*, *7*(1): 53-82.

Fransman, M. (1999) *Visions of Innovation: The Firm and Japan*, Oxford, Clarendon Press

Gandy, A. and Edwards R. (2016) “Enterprise Logic vs. Product Logic: The Development of GE's computer product line”. *Business History*

Gandy, A. (2012) *The Early Computer Industry: Limitations of Scale and Scope.* Basingstoke: Palgrave Macmillan.

Hague, D. & Wilkinson, G (1983) *The IRC – An Experiment in Industrial Intervention*. London: George Allen & Unwin

Hannah, L. (1984) (2nd Edition) *The Rise of the Corporate Economy*. London: Methuen

Hayward K. (1984) *The British Aircraft Industry*, Manchester University Press

Hendry, J. (1989) *Innovating for failure: Government policy and the early British computer industry*. Cambridge MA: MIT Press

Hills, J. (1981) “The Industrial Reorganization Corporation: The Case of the AEI/GEC and English Electric/ GEC Mergers”. *Public Administration*, 59: 63–84.

Jones R. & Marriott, O. (1970) *Anatomy of a Merger – A History of GEC, AEI and English Electric*. London: Jonathan Cape

Latham, J (1969) *Take-Over – the facts and the myths of the GEC-AEI Battle*. London: Iliffe

Milward R. and Singleton J. (eds.) (1995) *The Political Economy of Nationalisation in Britain, 1920–1950*, Cambridge, Cambridge University Press.

Nelson, R & Winter, S (1982) *An Evolutionary Theory of Economic Change*, Harvard.

Prais, S.J. (1981) *Productivity and Industrial Structure*, Cambridge CUP.

Teece, D. (2007) Explicating Dynamic Capabilities: The Nature and Micro-foundations of (Sustainable) Enterprise Performance, *Strategic Management Journal*, (28) 13: 1319-1350.

Teece, D. (2010) ‘Business Model, Business Strategy and Innovation’. *Long Range Planning*, 43 No. 2-3: 172-194

Tomlinson, J. (2004) *The Labour Governments 1964-1970: Economic Policy*, Manchester, MUP.

von Hippel, E. (1988) *The Sources of Innovation* (New York: Oxford University Press).

Williams, K., Williams, J. L., & Thomas, D. (1983). *Why are the British bad at manufacturing*? London: Routledge.

Wilson J.F. (2007) *Ferranti: A History, Volume 2, From Family Firm to Multinational Company, 1975–1987.* Lancaster: Crucible Books.

Yates, J. (2006) “How Business Enterprises Use Technology: Extending the Demand-Side Turn”. *Enterprise & Society,* 7(3): 422-455

Zahra, S. A., & George, G. (2002). “Absorptive capacity: A review, reconceptualization, and extension”. *Academy of Management Review*, 27(2): 185-203

Zollo, M. & Winter, S. (2002) “Deliberate Learning and the Evolution of Dynamic Capabilities,” *Organization Science* 13, (3): 339–351.

Williams, K., Williams, J. L., & Thomas, D. (1983). *Why are the British bad at manufacturing*? London: Routledge.

Wilson J.F. (2007) *Ferranti: A History, Volume 2, From Family Firm to Multinational Company, 1975–1987.* Lancaster: Crucible Books.

Yates, J. (2006) “How Business Enterprises Use Technology: Extending the Demand-Side Turn”. *Enterprise & Society,* 7(3): 422-455

Zahra, S. A., & George, G. (2002). “Absorptive capacity: A review, reconceptualization, and extension”. *Academy of Management Review*, 27(2): 185-203

Zollo, M. & Winter, S. (2002) “Deliberate Learning and the Evolution of Dynamic Capabilities,” *Organization Science* 13, (3): 339–351.

1. See, for example, Crafts and Hughes *Industrial Policy for the medium to long-term* For historical context see Chick *Industrial Policy* and Milward & Singleton *The Political Economy of Nationalisation*. [↑](#endnote-ref-2)
2. An analysis of this speech and a critical analysis of its impact can be found in Edgerton “The White Heat Revisited” and the speech itself can be found at <http://nottspolitics.org/wp-content/uploads/2013/06/Labours-Plan-for-science.pdf> [↑](#endnote-ref-3)
3. Hendry, *Innovating for failure* [↑](#endnote-ref-4)
4. Cmnd 2764 (1965) The National Plan, HMSO [↑](#endnote-ref-5)
5. Hill, “The Industrial Reorganization Corporation”, p64 [↑](#endnote-ref-6)
6. Ibid [↑](#endnote-ref-7)
7. See Tomlinson *The Labour Governments*, pp109-112 for details on the emergence of the IRC. [↑](#endnote-ref-8)
8. Cmnd 2889 (1966) *The Industrial Reorganisation Corporation*, HMSO [↑](#endnote-ref-9)
9. Carnevali *Europe’s Advantage*, p90 and Hague and Wilkinson *The IRC*  [↑](#endnote-ref-10)
10. Fransman, *Visions of Innovation*, p1 and Costanzo & McKay *Handbook of Research on Strategy* [↑](#endnote-ref-11)
11. Teece “Business Models, Business Strategy and innovation”, p172 and p178. [↑](#endnote-ref-12)
12. Chandler, “Enduring Logic of Industrial Success”, p131 [↑](#endnote-ref-13)
13. Tomlinson *The Labour Governments*, p112. [↑](#endnote-ref-14)
14. Teece “Explicating Dynamic Capabilities”, pp1322 – 1325. [↑](#endnote-ref-15)
15. See Prais *Productivity*, pp 177-178 for details of economies of scale as applied by the IRC. [↑](#endnote-ref-16)
16. FV 44/37, “GEC Exports” CDJ Lawrence, IRC, 5/12/1969 [↑](#endnote-ref-17)
17. Nelson & Winter *Evolutionary* p97. [↑](#endnote-ref-18)
18. Cohen & Levinthal. “Innovation and learning”: [↑](#endnote-ref-19)
19. Zahra & George “Absorptive capacity” [↑](#endnote-ref-20)
20. Zollo & Winter “Deliberate Learning” [↑](#endnote-ref-21)
21. von Hippel, *The Sources of Innovation;* Yates “How Business Enterprises Use Technology” [↑](#endnote-ref-22)
22. Bank of England Archive. 6A233/2 Economic Intelligence Department, Industry Group, 23/2/1972 [↑](#endnote-ref-23)
23. Wilson, *Ferranti: A History*, Volume 2, p5 [↑](#endnote-ref-24)
24. Jones and Marriott, *Anatomy of a Merger* and Williams et al., *Why are the British bad at manufacturing* [↑](#endnote-ref-25)
25. Ibid [↑](#endnote-ref-26)
26. Williams et al., *Why are the British bad at manufacturing*, p135 [↑](#endnote-ref-27)
27. National Archive EW27/257: RHF Croft, DEA, “Rationalisation of the Heavy Electrical Industry”, January 1967 [↑](#endnote-ref-28)
28. ibid [↑](#endnote-ref-29)
29. EW27/257 (DEA): RHF Croft, “Rationalisation of the Heavy Electrical Industry”, January 1967 [↑](#endnote-ref-30)
30. Ibid [↑](#endnote-ref-31)
31. Ibid [↑](#endnote-ref-32)
32. FV44/33 Hill Samuel “Notes for City Editors”, undated [↑](#endnote-ref-33)
33. FV44/33 Hill Samuel press release and letter to AEI shareholders on behalf of GEC, 13/10/1967 [↑](#endnote-ref-34)
34. FV44/33 “Hedges and Butler”, internal staff memo 18/4/1967 [↑](#endnote-ref-35)
35. FV44/33, Arnold Weinstock letter to “Ronnie” Grierson, 17/4/1967 [↑](#endnote-ref-36)
36. Ibid [↑](#endnote-ref-37)
37. Latham, *Take-over*, p40 [↑](#endnote-ref-38)
38. Ibid [↑](#endnote-ref-39)
39. F44/33, Hill Samuel “Offer by the General Electric Company Ltd”, to AEI ordinary shareholders, 28/10/1967 [↑](#endnote-ref-40)
40. FV44/33, AEI letter to stock holders, 20/10/1967 [↑](#endnote-ref-41)
41. Ibid [↑](#endnote-ref-42)
42. FV11/2 (MinTech) Mergers Panel “Proposed acquisition by GEC ltd of AEI Ltd” undated [↑](#endnote-ref-43)
43. FV11/2 Possible GEC/AEI merger, comments by L Division, October 1967 [↑](#endnote-ref-44)
44. Latham, *Take-over* [↑](#endnote-ref-45)
45. FV44/33, AEI letter to Ordinary Stockholders, 20/10/1967 [↑](#endnote-ref-46)
46. Ibid [↑](#endnote-ref-47)
47. F44/33 IRC Extraordinary Board Meeting, minutes, 23/10/1967 [↑](#endnote-ref-48)
48. FV11/2, MinTech, meeting note held on 2/11/67 [↑](#endnote-ref-49)
49. F44/33, JI McLaren, IRC, file note 2/11/1967 [↑](#endnote-ref-50)
50. FV44/33, Hill Samuel letter to AEI shareholders “Increased Offer”, 2/11/1967 [↑](#endnote-ref-51)
51. F44/33 Financial Times announcement held in the IRC files, 20/11/67 [↑](#endnote-ref-52)
52. F44/33, IRC letter to SSEB, 21/12/1967 (various other related contracts signed the same day) [↑](#endnote-ref-53)
53. F44/33, CRE Brooke, memo “Hedges/Butler”, 24/7/1967 [↑](#endnote-ref-54)
54. F44/33, Brooke to FE Glaves-Smith, Board of Trade, 5/10/1967 [↑](#endnote-ref-55)
55. F44/33, Note from Grierson to Brooke, 18/10/1967 [↑](#endnote-ref-56)
56. LSE archival collection: Second Lord Nelson, 5/5/64. “The development and organisation of the English Electric Company Ltd.” In London School of Economics, “Seminars on the problems in industrial administration”. [↑](#endnote-ref-57)
57. Gandy, *The Early Computer Industry* [↑](#endnote-ref-58)
58. Gandy, *The Early Computer Industry* [↑](#endnote-ref-59)
59. FV44/86, Agreement between IRC and English Electric, page 3, 17/7/1967 [↑](#endnote-ref-60)
60. FV44/86, file copy of the Board of Trade/MinTech statement to the press, 22/6/1967 [↑](#endnote-ref-61)
61. F44/29 MJ Knight “GEC Marconi Ltd”, 10/01/1968 [↑](#endnote-ref-62)
62. F44/29, English Electric 1967 Annual Report, March 1968 [↑](#endnote-ref-63)
63. F44/29 Knight “GEC Marconi Ltd”, 10/01/1968 [↑](#endnote-ref-64)
64. F44/29 Letter to Shareholders, Press Release and Background Notes, SG Warburg on behalf of Plessey 21/8/1968 [↑](#endnote-ref-65)
65. F44/29, Note of a meeting between MinTech and IRC officials, 21/08/1968 [↑](#endnote-ref-66)
66. F44/29, Industrial Case for the Merger of Plessey and English Electric, SG Warburg on behalf of Plessey 21/8/1968 [↑](#endnote-ref-67)
67. Ibid [↑](#endnote-ref-68)
68. Ibid [↑](#endnote-ref-69)
69. F44/29 IRC “The Plessey bid for English Electric” ref 68(89) 3/09/1968 [↑](#endnote-ref-70)
70. F44/29 “Meeting with Vickers” 5/09/1968 [↑](#endnote-ref-71)
71. F44/29 “Plessey bid for English Electric” ref 68(89) appendix 1, 3/09/1968 [↑](#endnote-ref-72)
72. F44/29 IRC “The Plessey bid for English Electric” ref 68(89) 3/09/1968 [↑](#endnote-ref-73)
73. F44/29 GJ Hearne “Plessey/English Electric Note for the File” 29/08/1968 [↑](#endnote-ref-74)
74. F44/29 “Meeting with Vickers” 5/09/1968

    F44/29 MJ Knight, “Plessey/EE” 3/09/1968 [↑](#endnote-ref-75)
75. F44/30 MJ Knight, “Plessey Company” 13/09/1968 [↑](#endnote-ref-76)
76. Ibid [↑](#endnote-ref-77)
77. Ibid [↑](#endnote-ref-78)
78. Ibid [↑](#endnote-ref-79)
79. Gandy and Edwards, “Enterprise Logic vs. Product Logic”, p2 [↑](#endnote-ref-80)
80. F44/30 MJ Knight, “Plessey Company” 13/09/1968 [↑](#endnote-ref-81)
81. F44/29, Note of a meeting between MinTech and IRC officials, 21/08/1968 [↑](#endnote-ref-82)
82. F44/29 IRC “The Plessey bid for English Electric”, ref 68(89), 3/09/1968 [↑](#endnote-ref-83)
83. Ibid [↑](#endnote-ref-84)
84. Ibid, draft p13 [↑](#endnote-ref-85)
85. F44/29 CA Hogg, “Plessey/EE: Meeting with Thorn”, 30/08/1968 [↑](#endnote-ref-86)
86. F44/30 CA Hogg, “Meeting with Sir Jules Thorn”, 12/09/1968 [↑](#endnote-ref-87)
87. F44/29 GJ Hearne “Plessey/English Electric”, note for file, 23/08/1968 [↑](#endnote-ref-88)
88. FV44/29 English Electric “Press Announcement”, 23/08/1968 [↑](#endnote-ref-89)
89. F44/29 CRE Brooke “Plessey/EE” file note 28/08/1968 [↑](#endnote-ref-90)
90. F44/29 Arnold Weinstock, GEC, to Sir Frank Kearton, IRC, 30/08/1968 [↑](#endnote-ref-91)
91. F44/29 CRE Brooke “Note for Meeting with Ministers”, 3/09/1968 [↑](#endnote-ref-92)
92. F44/29 “English Electric and GEC to merge”, joint statement 6/09/1968 [↑](#endnote-ref-93)
93. F44/30 “Statement by the President of the Board of Trade on GEC/English Electric merger”, 13/09/1968 [↑](#endnote-ref-94)
94. F44/30 CRE Brooke “GEC/EE/Plessey” note to file of discussion with Miss Piercy of MinTech, 2/10/1968 [↑](#endnote-ref-95)
95. F44/30 DJ Ewart “English Electric Loan”, note on discussions between Hambros, representing the IRC, and Lazards, representing English Electric 11/11/1968 [↑](#endnote-ref-96)
96. Plessey would face two unsolicited takeover bids by GEC in the late 1980s. The final bid battle took place in 1988-1989 via a joint GEC and Siemens offer which would be accepted by shareholders and which then divided the Plessey businesses between the two bidders, avoiding Mergers and Monopolies Commission restrictions on purely GEC bid for Plessey. [↑](#endnote-ref-97)
97. F44/30 “General Electric & English Electric Companies” internal memo 29/11/1968 [↑](#endnote-ref-98)
98. Ibid [↑](#endnote-ref-99)
99. BT333/17 (Board of Trade) “Briefing for President’s meeting with Lord Nelson on 25 March 1969” [↑](#endnote-ref-100)
100. F44/30 LD Ziman, file note on meeting with Weinstock on 17th April 1969, 29/04/1969 [↑](#endnote-ref-101)
101. BT333/17 HAH Cortazzi (Commercial Counsellor, Tokyo) to M Montague “General Electric/English Electric” 20/01/1969 [↑](#endnote-ref-102)
102. Ibid [↑](#endnote-ref-103)
103. BT333/17 “GEC’s attitude to exports” EWM Magor, 23/1/1969 [↑](#endnote-ref-104)
104. Ibid. [↑](#endnote-ref-105)
105. FV 44/37, “GEC Exports” CDJ Lawrence, IRC, 5/12/1969 [↑](#endnote-ref-106)
106. BT333/17 CHF Croft to Mr Fell, 15/1/1969 [↑](#endnote-ref-107)
107. Cmnd 2889 (1966) The Industrial Reorganisation Corporation, HMSO [↑](#endnote-ref-108)
108. Hayward *The British Aircraft Industry*, p14, and National Archive AVIA 63/135, 21st October 1959 [↑](#endnote-ref-109)