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**SWP 26/89    STRATEGIC RESPONSES TO PUBLIC  
INNOVATION POLICY -  
A CASE STUDY AND SOME POLICY  
IMPLICATIONS**

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**Strategic responses to public innovation policy  
- a case study and some policy implications**

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**Abstract**

Despite the considerable attention that has been devoted to the issue of government innovation policy and the effectiveness or otherwise of different policy measures, no attempt has yet been made to analyze how firms respond to such measures. In this paper we argue that such an analysis is essential both for a proper assessment of the values of alternative policy measures and for a proper understanding of how they might be most effectively implemented. Because there is in general a difference between the rhetoric of a firm's response to government initiatives and the actuality of that response, we argue that the response can in general be analyzed only by historical investigation. Drawing on a substantial historical case study of Government sponsorship of the early British computer industry we draw some tentative and preliminary conclusions on a range of innovation policy issues, and argue the need for further analysis of this kind, and for a much closer attention to the problems of implementation in the framing of policy initiatives.

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## 1. Introduction

Since the end of the Second World War, government in Britain, as elsewhere, has devoted substantial funding to measures designed to encourage the successful commercial exploitation of new technologies by industry. At the forefront of this operation have been organizations such as the National Research Development Corporation, the National Enterprise Board, and their joint successor the British Technology Group. But government has also sponsored a range of individual projects such as the Advanced Computer Techniques Project, the Pre-Production Order Scheme, the Product and Process Development Scheme, the Micro-electronics Support Programme, the Machine tool Industry Scheme and the Alvey Programme in information technology. Further funds have been channelled directly through the Ministry of Technology in the 1960s and the Department of Trade and Industry in the 1980s. And a considerable portion of defence procurement spending has also been directed towards the funding of commercially applicable innovations.

The principal aim of these various measures has been to assist the establishment of an internationally competitive national industry in areas of major technological change, by overcoming a range of perceived problems and barriers to innovation within industry itself. Although the existence of such problems has always been generally accepted, however, there is no clear consensus as to what precisely they are, or how they arise. In an analysis of the reports of the Advisory Council for Applied Research and Development in the late 1970s, Rothwell and Zegveld identified a wide variety of perceived problems including, among other things: a low emphasis on engineering skills and inadequate recognition of engineers, as compared with scientists; a concentration on glamorous high-tech projects at the expense of more mundane but economically more relevant areas of innovation; a lack of rapport between manufacturers of process machinery and their users; a shortage of venture capital for new technology projects, especially at

the pre-prototype development stage; an absence of profit levels sufficient to finance and encourage risk taking; a concentration on short-term returns and short-term financial criteria for investment; over-manning due to Trade Union pressures; burdensome government bureaucracy and legislation, for example on health and safety; and poor coordination between the private and public sectors.<sup>1</sup> Other problems commonly cited include the featherbedding of industry by defence spending, and the effect of defence contracts in encouraging esoteric and non-commercial designs;<sup>2</sup> the discouragement of investment by government fiscal policies;<sup>3</sup> a shortage of technically trained people in senior management positions;<sup>4</sup> poor relationships between firms and universities;<sup>5</sup> low job mobility between industry, the universities, and government agencies and establishments;<sup>6</sup> and the relative weakness of the profit motive in British national culture.<sup>7</sup>

Given this bewildering array of candidate problems, and given an almost total lack of consensus on which if any are key problems and which are not in fact problems at all, the selection of an appropriate policy measure is far from straightforward. Over the years successive governments have in fact tried a wide variety of different measures, including R&D subsidies, product launching aid, directed procurement, trial user schemes, joint industry-university research initiatives, user education programmes, new venture set-ups, patent pooling, and industrial reorganization.

The question is, do any of them work, and if so which? The answer is, simply, that we do not know. There have been attempts made to assess the relative effectiveness of different policy instruments, both through econometric analysis and through more qualitative comparisons, but these have been both limited in scope and inconclusive.<sup>8</sup> The extreme specificity of many of the measures, and of the situations in which they are applied, makes valid general comparisons virtually impossible. There have been studies of individual measures such as launching aid:

but whether this serves to encourage successful innovation as intended or merely attracts second-best projects, the firms funding worthwhile ventures themselves, remains an open question.<sup>9</sup>

There is not even a consensus as to whether the measures used have, as a whole, had any material effect, let alone as to whether or not they have been cost-effective.<sup>10</sup> If we ask whether they have succeeded in their primary task of establishing internationally competitive national industries, the answer must surely be no. But that is not to say that the situation might not have been even worse without them. The effects may simply have been neutralised by those of similar measures adopted by international competitors. If Pollard is right in his argument that the whole of British post-war economic policy has been imbued with the values of conservatism and with a distrust of, or even a contempt for, commercial innovation and investment, the measures designed to encourage innovation may even have been neutralised by their interaction with other aspects of government policy.<sup>11</sup>

In summary, it would appear that we cannot easily assess the effectiveness of innovation policy measures, either individually or as a whole, in terms of their overall economic results. There is no reason, however, why we should not pursue another line of attack and investigate their immediate consequences, in terms of how individual firms have responded to the measures. Indeed, we may go further than this. Since the immediate aim of innovation policy measures is to influence firms' behaviours, any proper evaluation of the merits of these measures must surely take account of how firms respond, or may at least be expected to respond, to them, in the particular environment and circumstances concerned.

Such an approach does not, of course, have the generality of an economic or econometric analysis. But it does have several important advantages. In particular it allows us, in principle at least, to distinguish between the effects of the

policy measures themselves and any other environmental or political effects with which they might interact. It also allows and indeed forces us to distinguish between the policy measures themselves and the mode of their implementation. Though automatically recognized as important in any analysis of corporate policy, this distinction is rarely made in the context of government policy. Yet in any analysis of the effects of government policy it is how the policies are implemented, and not how they are formulated, that is of crucial importance.

## 2. Policy implementation and firm response

Remarkable as it may seem, this question of how firms respond to specific innovation policy measures has never been directly addressed within the policy literature. The general presumption appears to be that the passage from a policy's formulation by government to its implementation in industry is not in itself problematic. The firm's response is taken for granted and taken, moreover, at face value. It takes very little reflection to realize, however, that the apparent response of a firm may be very different from its real response, and that the latter may well differ significantly from what was envisaged by the policy-makers.

To give just one example of the latter point, Dosi has observed that European government policies for the microelectronics sector have in general been based on the assumption that corporate strategies are broadly speaking consistent with public policy objectives.<sup>12</sup> In practice, however, as he notes, this is far from being the case. Indeed the theoretical justification of government sponsorship is based partly on a well established difference between the social and private rates of return from an innovation, and on the argument that while the former is of interest to government as representative of the community as a whole, it is the latter which provides the basis for corporate decision making.<sup>13</sup> Even if this difference

were to be removed, the company board room and government agency would still be characterised by different cultures, different experiences, different priorities and different perceived constraints, leading to different and incommensurable rationalities.

These differences are also reflected in the difference between a firm's public, or rhetorical response to government measures, and its private or actual response. A firm's public response may be expressed in the language and context of government concerns, and phrased in such a way as to imply conformity of private and public objectives. But the private response will be conceived in the language and context of the board room, and will indeed be designed explicitly to cope with the difference between private and public objectives.

This difference takes on a particular significance where the public policy rests on some form of coordination or cooperation, things which can be readily created in form without necessarily having any reality in substance. Most policy measures do in fact incorporate some form of collaboration - between firms, in pre-competitive research, between firms and government establishments or universities, between different government agencies, etcetera - but neither the theoretical form of this collaboration nor the rhetoric of those involved in it is necessarily any guide as to what is taking place at a substantive level. The rhetoric will be guided by a desire to maximize both funds and funding. The practice is more likely to be dictated by the internally established aims and priorities of the organization in question.

All this points strongly to the need to probe beyond the rhetoric of firms' responses to innovation policy measures and investigate what effects these measures actually have on the firms' business strategies. The problem is, of course, that it is not in the firms' interests to reveal this: if there is a gap between the rhetoric and actuality of a firm's response there must also be good

reasons for concealing this gap. This means that the investigation cannot easily be carried out in real time. It can, however, be carried out historically, once the issues which dictated the rhetoric cease to be of importance or concern, and this is the approach we propose to adopt here.

### 3. The case study

An understanding of this subject sufficient to provide a basis for future policy and implementation decisions would of course require a massive programme of historical research, and this is a task for the future. Our aim here is to demonstrate the feasibility and value of the approach by outlining some of the conclusions from a detailed historical study recently carried out of the interaction between the National Research Development Corporation, or NRDC, and the infant British computer industry, in the formative period for that industry of the 1950s.<sup>14</sup>

The technology of computers is one of the most important of the post-war new technologies, and many would argue that it is the most important. Its establishment as a technology with commercially feasible applications owed a lot to British scientific and technological inventiveness. As with so many other new technologies, however, British industry was slow to exploit it and soon lost out to foreign (in this case American) competition, failing to establish an internationally competitive domestic industry. In these respects computer technology provides something of a paradigm for new technologies in general. What makes it even more interesting from our present perspective is that the failure was achieved despite a determined and committed programme of government assistance. The birth of computer technology coincided with the birth of the NRDC, charged specifically with assisting the commercial exploitation of new technologies. The first managing director of the NRDC, Lord Halsbury, had a strong personal interest in computers, and was from the beginning totally committed to the establishment of a British computer industry able to compete internationally

and, in particular, with the American giant IBM. For ten years he tried everything he could to bring this about, and for ten years the activities of the NRDC were dominated by computer technology.

The experiences of the NRDC and the early British computer industry are not of course universally applicable. They were conditioned in particular by the terms of reference of the NRDC in the period concerned, and by the historical social and economic context of that period; by management styles that may now seem dated, and by a specific industrial structure, both nationally and internationally. They did not cover the full range of policy instruments. Against this, however, the main instruments used were of a type that has remained central to British innovation policy. Many of the problems encountered were generic to both new technology industries and British industrial culture. And the historical evidence available is unusually good, allowing us to probe more deeply into our subject, with more subtlety and greater sureness, than is generally the case.<sup>15</sup>

#### 4. Observations

##### 4.1 "Pushing mules uphill"

From the practical viewpoint of implementation, the basic problem for government technology sponsorship, and indeed for industrial sponsorship in general, is that the firms involved do not generally want to do what government wants them to. If they did, there would be no need for sponsorship. This means that in order for sponsorship to succeed it must serve to change the thinking and behaviour of the sponsored firms. If it cannot do this it will result only in rhetorical accommodation, and will effectively be wasted.

To what extent, then, does sponsorship actually effect corporate strategy? In a study of the French government's sponsorship of the microelectronics industry, Dosi has made two important observations.<sup>16</sup> First, he suggested that the government policy as enacted came about as a consequence of a stalemate

between the original public policy objectives and the objectives of the firms concerned, together with a further stalemate between the objectives of different firms. The firms responded to government in their own terms, not in the terms of government. Secondly, when the government established a new firm, CII, as a joint subsidiary of two existing firms, CGE and Thomson, these firms treated it as an unwanted child to be sent to the orphanage, in Dosi's analogy, as soon as possible. Similarly SESCOM, set up as a joint venture between Thomson and the government, was for many years kept alive by repeated injections of public funds, with little or no commitment from Thomson. If a firm does not want to do something - if that something is incompatible with its own, privately developed, corporate strategy - then government money will make little real difference. There is little to be gained from the sponsorship of unwilling firms.

Both these observations find strong support in our case history of the British computer industry, and through this case history we can also see some of the processes underlying them at work. Already conscious of the threat posed by IBM, one of the NRDC's principal aims in the early 1950s was to push the British punched-card machinery companies, British Tabulating Machines (BTM) and Powers-Samas, to move rapidly into computers. They were of course convinced that this was in the national interest, but they were also convinced that it was in the interests of the individual firms as well. Inevitably, however, the NRDC's view of a firm's interests was very different from the firm's view of its own interests. Whereas the NRDC sought major changes that would pave the way for long term competitiveness, the firms sought merely survival in the short term. Unable to comprehend the importance of the technical changes that were taking place, the firms' directors responded by discounting those changes from their calculations - by assuming that the only changes that could take place were those they could understand. In the case of Powers-Samas, this view was reinforced by

the corporate strategy of its major shareholder, Vickers, for whom the company was a useful source of revenue which helped utilise Vickers' own excess manufacturing capacity - not the basis of a radical new industrial departure. To try and change these attitudes was, to use Halsbury's own analogy, "like trying to push mules uphill".

The firms' responses were not, however, simply blinkered. At the time both had what seemed to them more important things to worry about. BTM had just broken their traditional ties with IBM and were embarking on a crash programme of expansion of their customer base so as to meet anticipated competition from IBM in respect of their existing product lines. Powers-Samas had also just broken away from their American partner (Remington Rand), and were desperately trying to consolidate after a run of difficult years that had all but drained the company's resources. Neither firm felt able to divert scarce resources from what might well prove to be a battle for survival into speculative long-term developments. The courses advocated by the NRDC would have involved considerable risks in the short term, and to rate the importance of short term survival highly was not at all unreasonable. So the problem was not simply one of the NRDC being right and the firms wrong. Rather it was one of conflicting rationalities. The firms responded to any NRDC suggestion in their own terms, and the only way the suggestions could have had any significant impact would have been if the NRDC had accepted and worked within those terms.

Similarly with the electronics companies, Ferranti and EMI, who were the two major recipients of NRDC development and launching aid in the period. Repeatedly in its dealings with Ferranti the NRDC bemoaned the fact that Sir Vincent de Ferranti, the chairman, insisted on seeing things in his own, to them very idiosyncratic, way. But this was natural and right. Sir Vincent controlled the company and was personally responsible for it, and any response to the NRDC had to be formed in, and was bound to be

conditioned by, this context. In the case of EMI, the NRDC came away with the impression that there had been a meeting of minds and that EMI were responding in the full spirit of the NRDC proposals. In fact, however, that impression was illusory. EMI too responded in their own terms. It so happened that the NRDC proposals fitted in with their view of things, but they did not fit in in the way the NRDC thought they did. Although EMI appeared as a firm to be the most willing of partners, they actually had little interest in carrying through the projects as the NRDC wished, and the sponsorship given them made no difference to this basic fact. Despite the rhetoric the company was never really behind the NRDC sponsored projects, and this was clearly reflected in their outcomes, one project leading to a computer design of which just 4 were sold, and the other being abandoned altogether. This is not to say that the company were in any way dishonest in their dealings with the NRDC, merely that the aims of the two organizations were different, and that when difficult decisions had to be made within the firm their own aims naturally dominated.

Similar situations also arose with other firms. In the first ten years of the development of the British computer industry the NRDC sponsored half a dozen major projects and many minor ones, and sought unsuccessfully to set up many more. But at no time did the aid given or offered to any firm make any perceptible difference to that firm's business strategy.

#### 4.2 Helping to no advantage

Besides the general inappropriateness of the policy measures to their own strategic aims, another factor dominating the firms responses to the NRDC and contributing to that body's lack of real influence was that the amount of aid under offer was never seen as sufficient to supply the firms with a worthwhile competitive edge. This reflected of course on the NRDC's specific terms of reference and on the limited sources of finance at their disposal. But it was also a reflection of something deeper

and more pervasive in British innovation policy. For while the avowed aim of the NRDC was to provide the British computer industry with a competitive advantage over its international rivals, a dominant principle of the implementation of that policy was that no one British firm should be given any competitive advantage over another.

Our study of the implementation of the NRDC's policies revealed a chronic obsession, apparently derived from established defence procurement practices, with fairness. Nothing was to be done which might in any way give, or be perceived as giving, any "unfair advantage" to a firm. When one of the computer firms was offered a development loan the repayment terms offered were generally rather different from those that would have been offered by a commercial lender. Typically, the NRDC would take on some part of the risk of the project failing, and seek a proportionate reward if it were to succeed. But overall the terms were little less onerous financially, and rather more onerous in other respects, than if the loan had been made commercially. Nor were any other benefits permitted to accrue to the firm, for example through preferential licenses or guaranteed government purchases of the ensuing products.

Again, assistance was offered for technological developments, or even for products very closely identified with such developments, but not for any product developments of which the technology was only a part. There was usually a condition on the firms that no privately owned inventions should be exploited at the expense of publicly owned ones. And when an invention was singled out for publicly-funded exploitation care was always taken to ensure that neither the inventor nor the exploiting firm should profit too much thereby. When, occasionally, grants were offered, or loans on favourable terms, they had to be available to every firm able to meet some appropriate technical criterion.

A similar insistence on fairness to that observed in the case study would appear to general feature of innovation policies in

Britain, and it is all very laudable in its way. The problem is that it virtually eliminates any chance of the policies being successful. For given that the aim of sponsorship is to establish a commercially successful firm or firms where otherwise there would be none, the most appropriate recipient of government assistance is precisely that firm able to make the greatest commercial success out of it, or most likely, in other words, to secure what might be interpreted as an unfair advantage. If a sponsored firm does not secure such an advantage then, to put it bluntly, the policy has failed.

Moreover, if a policy is to result in a firm securing an advantage where previously it had none, it must put in something of real competitive value. In the great majority of the instances detailed in the case study, the firms accepted the NRDC's assistance because it was offered, or more usually pressed on them, because it gave them some access to information on what their competitors were doing, and because it established them in a favourable light, or so they hoped, in government circles. Had they believed that the developments concerned would have given them a competitive advantage they could and would have funded them commercially. As Vincent de Ferranti exclaimed at one point in response to an NRDC proposal: "I can get better terms from the bank!"

#### 4.3 Threats and opportunities

We mentioned earlier the general failure of the NRDC to persuade the punched-card firms to go into computer development in the early 1950s, when this did not tie in with the firms own strategic objectives. It is interesting to note, however, that there was one way in which the NRDC was able to influence the behaviour of these firms, and that this was not by offering them grants or subsidies at all, but by offering these to other firms. BTM, with a clear corporate view of their competitive environment, could not at first be persuaded to develop computers, and it was only when the NRDC threatened to take their sponsorship elsewhere that they responded even in rhetoric. And only when



NRDC sponsorship of the electronics firms Ferranti and Elliot Brothers brought home to BTM the possibility of new competitors entering their field of business did they actually instigate a serious, albeit small, computer development programme.

To offer a large firm a small amount of assistance to act in a certain way actually changes very little in terms of that firm's perception of its competitive environment and possible strategies. To tell the firm that it may have serious competitors if it does not act as required may produce a rhetorical response, but actually changes nothing and so leads to nothing. But sponsoring a competitor, even though it may do little for the competitor's own position, does change the perceived competitive environment of the original firm, and so encourages a reassessment of strategy.

A similar conclusion may be drawn from an analysis of the process by which the computer industry was restructured in the late 1950s and 1960s, a process that was also covered in the case study. From the early 1950s the NRDC view was that a competitive British industry could only be created, in the end, by a process of restructuring involving mergers between firms in the office machinery and electronics sectors. It was apparent to them, as well as to outside commentators, that such mergers offered tremendous opportunities for the firms concerned. When the industry did restructure, however - there were seven major mergers or takeovers from 1958 to 1968 - it was in response to threats, not opportunities. Each and every acquisition was defensive, both on the part of the buyer and on that of the seller.

These observations are moreover supported by recent work on the cognitive elements of strategic decision making. In particular, Dutton and Jackson have analyzed the differences in decision makers' responses to stimuli, depending on whether these are categorized as threats or opportunities.<sup>17</sup> And they have concluded, among other things, that situations perceived as threats lead to significantly greater responses than

those perceived as opportunities. Threats are more powerful than promises.

How far this argument can be taken in a policy setting is not clear. Whether one could sustain a policy of sponsoring the firms in which one wasn't interested in order to shift the behaviour of those one was must be doubtful. But the argument does provide some support for a policy of sponsoring new firms and new ventures, some of which will perhaps thrive and grow while others merely spur established firms into action. And the general point that many firms will only respond defensively, and that government policy should take account of this, is surely a significant one.

## 5. Conclusions

The conclusions that can be drawn from a single case study are necessarily of a preliminary and tentative nature. Some general conclusions do however suggest themselves:

**Conclusion 1.** The implementation of specific public policy measures is unlikely, in general, to have any significant effect upon the strategic thinking of the firms concerned. It may therefore be necessary for government to match its policies to existing corporate strategies, rather than attempting the reverse process.

**Conclusion 2.** To the extent that firms will adapt their strategies to policy measures, they are more likely to respond defensively, to threats, than aggressively, to opportunities. It would therefore make sense for government policies to play on their defensive instincts, than to rely on aggressive instincts they patently do not have.

**Conclusion 3.** Innovation policy measures are only likely to have any significant effect if they convey to the firms concerned a significant competitive advantage. This suggests that notions of fairness may have to be abandoned, and assistance directed towards those firms best able to capitalize on it, even if other firms suffer as a result. The name of the game should be "back the winner".

One final conclusion, more tentative still but of considerable interest, concerns the role of small firms. Innovation policy measures in Britain have generally been focused predominantly upon large established firms, for the fairly obvious reason that such firms are the best placed to succeed in an international market place. Our study provides clear support, however, for a contrary argument. Specific policy measures are likely to have a much greater effect upon the achievements of small firms, for whom a relatively small amount of assistance may make quite a large difference to their funding or resource base, than upon those of larger firms. The small firms are more likely to respond aggressively to innovation opportunities. Their strategies are more likely to be in line with the policy aims. The small firms themselves may not grow quickly into major players in the international market. But their existence as both potential competitors and potential acquisitions will encourage and help the larger firms to make the necessary moves into the new technologies when their own strategic plans make this desirable. And the stronger the small firms are, the faster this restructuring is likely to take place.

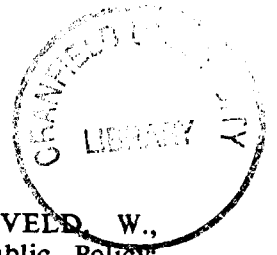
Following a major study of the development of corporate life-cycles, Mintzberg has recently proposed that instead of assisting old and established firms,

government policy should be aimed at killing them off and encouraging the young ones.<sup>18</sup> The first part of this prescription may be too radical to be of any practical value, but by the very act of supporting the young firms we might at least persuade the older ones to have blood transfusions.

**Conclusion 4.** Government sponsorship of innovation should be directed at small firms as well as large, and unless there is good evidence to the effect that a large firm will make use of the sponsorship in the spirit in which it is intended, the presumption should always be in favour of supporting the smaller and younger firm.

## FOOTNOTES

1. Rothwell & Zegveld, 1981.
2. See for example Rothwell, 1986.
3. See for example Pollard, 1984.
4. See for example Rothwell & Zegveld, 1981.
5. Ibid.
6. See for example English & Watson Brown, 1984.
7. Wiener, 1985.
8. Rothwell & Zegveld, 1981; Mansfield and others, 1977.
9. See Eads and nelson, 1971; Gardner, 1976; Mansfield and others, 1977; Rothwell and Zegveld, 1986.
10. See for example Rothwell, 1986.
11. Pollard, 1984.
12. Dosi, 1981, 1984.
13. See for example Willott, 1981; Mansfield and others, 1977; Rothwell & Zegveld, 1981.
14. Hendry, 1989.
15. The main sources are the computer archives of the NRDC, now deposited at the National Computer Archive at Manchester University, the archives of ICL and its predecessor companies, held by the ICL secretariat, and a range of documentation held by other companies and individuals involved in the industry. Full details of these and other sources are given in Hendry, 1989.
16. Dosi, 1981.
17. Dutton & Jackson, 1987.
18. Mintzberg, 1984.



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