'Innovation for Failure – Some Reflections on the Work of the NRDC Relevant to the Early History of the Computer Industry in the UK'

THE RT HON. THE EARL OF HALSBURY

Some years ago Dr Hendry sent me the manuscript of his book 'Innovation for Failure' as a matter of courtesy, since I appear in it so often. I read it, thought it excellent and corresponded with him about it. We met and exchanged views. Now the final version has been published and I have been asked to write an essay review on it. An essay review is a rather hybrid term. An essay comments on the content of a book assuming the reader is familiar with it. A review should enable one who has not read it to decide whether to acquire it with a view to doing so.

By way of review I can only praise it as a splendidly documented account of what I accomplished or failed to accomplish to get the computer industry going in the decade 1949/59. As to accomplishment, I laid the foundation of NRDC's success for the future in all fields save that of computers, my single largest preoccupation, though only one of many. As to failure I am recorded at half time as saying 'I have spent five years pushing mules uphill'. At close of play my dictum went 'I can supply money and initiative but not willpower unless I am in executive control' (which I never was). I will now go through Dr Hendry's work chapter by chapter to give the reader an idea of what it is all about.

Chapter 1 starts with an excellent appraisal of why the National Research Development Corporation (now the British Technology group) came into being at all. It omits one rather important factor, namely Stafford Cripps' insistence that the rather detached view of HMG to employees' inventions needed reform. Patentability in the inventor name subject to 'Free Crown User' with the inventor free to license his Patents to all comers at his discretion was to be replaced by 'Assignment to the Crown or its Nominee' (NRDC in due course) with a claim on the Departmental Awards Committee (to be brought into being) as compensation for the inventor's loss of the right to license.

Chapter 2 is an insightful critique of the difficulties resulting from the un-insightful terms of reference written into the text of the Development of Inventions Act (1948) and only partly corrected in the Amending Act of 1954. The mere decision to embark on the development of an invention entails an early commitment to research for the solution of any problems arising. But NRDC's activities were restricted to the development of patented inventions only. It had no authority to commission research in principle, without which the patent might be valueless.

In order to render the Act of 1948 a non-party piece of legislation, the Board of Trade (represented by Harold Wilson) accepted an amendment, at the Report stage of the bill, requiring NRDC to place development contracts with firms engaged in the industry concerned. It did not contemplate that there might not be any industry to one of whose firms development could be assigned. Dr Hendry's insight into the problems this landed me with is excellent. I was, in the context of computer, struggling to overcome them, but with never more than partial success. If I looked like doing so I tended to get a rap over the knuckles for exceeding my terms of reference. These Dr Hendry dichotomises into 'formal' and informal'. I can't say that I ever described them as such, in so many terms, or in those precise words at the time, but with the passage thereof I think that Dr Hendry's analysis is, again, insightful and useful.

Chapters 9 and 10 relate the rather sad tale of two projects that went wrong. The EMIDEC 2400 was designed to a specification agreed between Clifford Metcalf, the MD of EMI Electronics, and me, following a trip of his to the US. I told him what to look for, consequential upon my own annual visits to the States every fall. Unbeknownst to me, however, EMI were setting up a rival project, more to their liking in terms of their experience, internally funded and a rival for soaking up the available personnel, the EMIDEC 1200. Had I known this at the time I would have sought another contractor, but I only discovered it too late.

The other failure was not of my making. It started with a request from Harwell to build a computer for their own use with NRDC money. This I could not agree to on the terms proposed, but neither could I disregard it altogether. During the ensuing studies, so many people tried to climb aboard the bandwagon that it became a case of too many cooks spoiling the broth. It overlapped with my own plans for personal retirement. At my last Board meeting, Hennessey manoeuvred to get it going on his own lines. It was never built. The Ferranti Atlas was built instead with support from NRDC. By then I had retired and have either forgotten it or was never told it. I am grateful to Dr Hendry for the information. Octogenarians' memories of what happened thirty years ago are not to be relied on, as witness the misinformation I gave Dr Hendry respecting the identity of the passenger seated next to me on a home flight from the US. It wasn't Bill Elliott but C. Laws. *Mea maxima culpa!*

I now come to the most important part of this essay, namely a critique of Dr Hendry's conclusions. First I look at them from an overall point of view. He writes with admirable candour that his conclusions are based on a single case study but that another investigator has come to the same sort of conclusion. I would accept their conclusion for the most part so far as innovation for failure *in the computer industry* is concerned, but not so far as NRDC is concerned.

During my period as Managing Director the total borrowing from the Board of Trade was £2.8 million, to which must be added £0.3 million accumulated interest, making £3.1 million overall. This was used to finance expenditure of £2.7 million, of which £1 million was

offset by retained earnings. These borrowings and further borrowings after my time had, by 1979, all been repaid with accumulated interest, mostly out of earnings from projects started in my time. The Pyrethrin insecticides were just appearing over the horizon when I left. They have, this year, come to the end of their earning capacity and will cease to contribute next year. I always said that the life of a patent (in my day) being sixteen years, the maximum time allowable to break even should be sixteen years. Otherwise a failure. But since patented processes generate further patents the allowance for break-even or fail must be measured from the date of the last patent in the portfolio of patents associated with a given invention. The overall break-even point was in fact 23 years. Thereafter NRDC operated at an annual profit.

In due course NRDC was amalgamated with the National Enterprise Board under the title of the British Technology Group (BTG), now scheduled for privatisation. NRDC proved the dominant member in the merger. According to their latest annual report, licence income was £25 million, providing revenue-sharing payments to inventors or universities of £5.5 million.* Profit before tax was £9.5 million and after tax £6.8 million. Of this £3.4 million was paid to the government as dividend and £3.4 million carried forward, carrying the balance on profit and loss account, another £3.4 million, to a cumulative £30.56 million. Support for new inventions during the year was £7.6 million.*

Looking to the future, they claim world leadership in the handling of intellectual property rights and are moving into Europe. They are delighted at the prospect of being privatised. The Annual Report lists as the main headings covering their activities pharmaceuticals, science-based advances in materials or instruments, general engineering, electronics and information technology and lastly inter-corporate licencing. Only the last of these headings is since my time. The rest reads like an old NRDC report.

I am driven to the conclusion that Dr Hendry's excellent work should really be entitled 'Innovation for Failure in the Computer Industry'. There was something special about the computer 'non-industry' which went unresolved by me, though not for want of trying. Failure is manifest to this day, since 80% of the industry represented by ICL was recently sold to a Japanese group for £800 million. So it was a billion-pound industry, as I foresaw it was going to be, though I was unable to persuade others of my view. This makes Dr Hendry's book more, rather than less, interesting.

Why was it that I had this conviction when no one else did? The answer is simple. It was pure chance, the consequence of not going to a university as a school-leaver but being instead articled to a prestigious firm of chartered accountants, Deloitte Plender Griffiths and Co. The very first audit I went on was of Powers Samas Accounting and Tabulating Machine Corporation, whose headquarters were in Chancery Lane and whose factory was near Thornton Heath Pond in Croydon. At the latter, the auditors were invited to sit at the manager's table for lunch, where I got into conversation with one of their engineers. He described to me a German advance in

*These two items added together amount to the £13.1 million referred to in the Chairman's report as 'returned to the academic sector'.

the application of the punched card idea. It would enable a very complicated machine to keep the books of a whole bank. He was rather dubious about it. 'If one machine, plus operator to keep it working, were subject to hazards what would happen in the event of a machine breakdown or the operator taking to his bed with influenza? If there is an influenza epidemic ten bank clerks are unlikely to get it simultaneously. And if there are ten machines they are unlikely to break down simultaneously'. It was only a casual conversation over a meal, but I was young and impressionable and became haunted over the next twenty years with the concept of a universal machine coupled to the need for reliability. During this period I left accountancy and graduated as an external student with a degree in Chemistry and Mathematics. As an intellectual hobby I studied, after graduation, boolean algebra, mathematical logic and differential analysers. A friend of mine, John Benson (later Lord Charnwood), built a copy of Hartree's analyser in Meccano and we played with that. I also studied as much of electronic circuitry as would suffice to make a pre-war television set. I remember, too, reading an article in *Nature* on the ENIAC and adding this to my haunting.

When I became Managing Director of NRDC I found the Williams cathode-ray tube storage patents awaiting exploitation and IBM waiting to become a licensee. I felt the finger of destiny pointing at me as I took my first transatlantic flight in August 1949 to visit computer establishments in the US. Thereafter I made regular trips to the US every year, in the fall, to keep myself permanently abreast of what was going on. Ten years later, I left (according to Dr Hendry, 'unable to conceal a note of pessimism') which he deduces from a paper printed in *The Computer Journal* for 1959 and reprinted as an annex to the present review (by courtesy of the Editor). I was succeeded by John Duckworth. The Board of Trade and the later Ministry of Technology started to pressurise the NRDC away from computers and towards other matters. According to Dr Hendry, Duckworth did not share my 'passionate personal' interest in computers and was quite happy to redeploy NRDC's efforts. In any case the advancing front was beginning to shift from hardware to software and I became, in succession, the Chairman of the SRC's Software Committee, then a member of the SRC, then of the Computer Board for Universities and Research Councils and finally Chairman of the Atlas Computer Laboratory. When it seemed that I was finally out of the game, I found myself Chairman of the Meteorological Committee, whose policy was always to equip the Meteorological Office with the world's most powerful computer for forecasting purposes. So that is the history of my involvement with computers from the age of 20 to the age of 74, a span of over fifty years.

I turn now to Dr Hendry's four numbered conclusions in the order in which he presents them. With his first and second conclusions I am in agreement subject to some qualifications which I will recite below. With his third and fourth conclusion I agree wholeheartedly.

First. 'The implementation of specific policy measures is unlikely, in general, to have any significant effect on the strategic thinking of the firms concerned. It may, therefore, be necessary for government to match its policies to existing corporate strategies, rather than attempt the reverse process.'

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Comment. So far as computers were concerned there was *no* corporate strategy. The only discernible policy I could have matched was one of 'watch and wait'. If NRDC had not existed the government could have done no more than match it likewise. But watching and waiting was exactly what I had a remit to reverse. In 1950 I did my best to encourage the splintered components of what was to become an industry to meet round my board table. As we came down from the meeting, Victor Stammers of BTM whispered to me, sotto voce: 'You haven't got what you wanted, but you may have started something that will bear fruit'. Sixteen years later the fruit dropped off the tree. Too little, too late.

Second. '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 rather than to rely on an aggressiveness they manifestly no longer have.'

Comment. This may be true, but if so I doubt if I would be the right chief executive to implement it. In so far as I might have threatened, at the time it would have been unconsciously so, as I don't like threats as a device.

Third. 'Innovative policy measures are only likely to have any significant effects 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 toward those firms best able to capitalise on it, even if other firms suffer as a result. The name of the game should be "Back the Winner".'

Comment. I couldn't agree more. What I wanted to back, and would have, to the hilt if I could have found it, was a fierce eager will to succeed. I found it, after my time, in Ian Barron who in my time had not yet emerged from the background.

Fourth. 'Government sponsorship of innovation should be directed at small firms as well as large ones, 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 younger and smaller firm.'

Comment. Again, I couldn't agree more. The following anecdote is relevant. On going round the IBM laboratories once, I was shown a device which has become more or less standard on all print-out devices to this day. 'Clever, isn't it?' my host commented and added 'The inventor is a youngster whom we are supporting by giving him money to keep going and facilities from our resources here. We reckon he's much best left to his own devices with support from us than by being absorbed into this enormous outfit as an employee who must toe the line. We've got quite a number of these support projects in being.'

Two brothers in the printing trade, Vesey Strong by name, backed an inventor, Paul Eisler, whose system of printed circuits turned out to be the winner. They ran out of funds and came to NRDC for help. I saw in it a contribution to the elimination of dry joints, the bane of the precision electronics industry, and financed further work, taking a convertible debenture on Technograph Printed Circuits Ltd, so that if the outfit failed we would be a priority creditor and if it succeeded we could convert into equity stock and enjoy our revenues. In order to secure the latter we successfully brought suit for infringement worldwide, a task which the original backers could never have financed. The computer industry got the benefit and was clear of some of its circuitry problems which, as I once remarked, were less of a manufacturing operation than an emotional experience. Long live the small firm.

There is one issue on which I feel inclined to argue: the position in NRDC of the late Professor Christopher Strachey. Dr Hendry argues that a body such as NRDC should not employ its own high-level technical experts. In general terms I agree with this. Its field of activity is so wide that to cover it with such people in every context would be quite uneconomic. Strachey's was a special case. He was highly recommended to me by no less a person than Turing himself. His point was that anyone as gifted as Strachey must not be left to lie fallow as an assistant master at Harrow but must be recruited to the computer in some capacity or other. In the course of a long session with him, Strachey gave me all the reasons why he would not work in industry or in a university or leave London. During this exchange of views I rather got to like him and asked him if he would care to work for NRDC in a trial capacity. He agreed to give it a trial and, when the trial period ended, he made it clear that he wouldn't work for anyone else. When I left, he left too and set up, first as a consultant, then as the guest of Maurice Wilkes and then of Imperial College. Finally he became Professor at Oxford in Computing Science. There he installed one of Ian Barron's computers as the work-horse for recursively written operating systems. On giving his first such system its trial run, legend has it that he debugged it within twenty-four hours.

When not arguing a case he had considerable charm and was a popular guest lecturer on many a campus. These visits gave him insight into what was going on elsewhere in the world's computing centres. He frequently criticised people for not getting around enough and becoming too parochial. In argument, he once admitted to me that he was a bully; that he expected the other guy to admit defeat or go on arguing till one of them won. He was a pioneer of user-friendly designs. The design of the Pegasus with its eight accumulators was finalised just so. He drove all opposition to exhaustion. He was a '*lusus naturae*' and nothing can be deduced from the licence I gave him. His like will not come again. Peace to his ashes.

My last words should be of thanks to Dr Hendry for reminding me of the details of forty years gone by, some of which I had forgotten but now recall, and for allowing me a glimpse of what was going on on 'the other side of the hill', via the Board minutes of the firms with whom I dealt but which of course I never saw while dealing.

Editor's Comment: To give a background to the work of the NRDC and the early computer industry in the UK, we reproduce a paper written by The Rt. Hon. The Earl of Halsbury which appeared in *The Computer Journal*, Vol. 1, No. 4 and which is quoted above. Relevant letters also appear on pages 206 and 264 of this issue.