The UK IT Industry after World War II

The National Research and Development Corporation (NRDC)

Why the NRDC?

Initially I thought of researching some of the leading firms and institutions in the UK IT industry of this period. I considered Manchester University, Ferranti, Elliott Automation, International Computers and Tabulators Limited (ICT), and International Computers Limited (ICL) and others.

They are representative of the era, but I found they only told part of the story. A series of mergers and developments finally shaped them. The power behind mergers can often be due to the appropriate linkage of suitable independent firms, and the Government was the catalyst for making some of this happen.

After deciding to focus on the Government as the center point of my project, research began by studying political actions relevant to the development of the IT industry. First, I focused on the Ministry of Technology, established by the incoming Prime Minister Harold Wilson and his Labour Party government in 1964. However, there is gap in the timeline, from 1945 to 1964; what did the Government do between 1945 and 1964? How did it create and empower the Ministry of Technology? I realized that the establishment of the National Research and Development Corporation (NRDC) was an important part of this and decided to focus on the actions of the NRDC over this period.

I will look at three specific organizations that were active in this period; one is the NRDC itself, a non-departmental government body established by the British Government to transfer technology from the public sector to the private sector[1]. The others are two major UK companies: Ferranti Ltd.[2] and Elliott Brothers (London) Ltd.[3].The contrast is obvious; their interconnection

[1] The National Research and Development Corporation from Wikipedia https://en.wikipedia.org/wiki/National_Research_Development_Corporation
[2] For the history of the Ferranti Ltd., please see its Wikipedia page: https://en.wikipedia.org/wiki/Ferranti
[3] For the history of the Elliott Brothers (London) Ltd., please see its Wikipedia page: https://en.wikipedia.org/wiki/Elliott_Brothers_(computer_company)

illustrates a picture of how government and computer companies negotiated, and looked for mutual benefits in their relationships. Besides scientific progress, social and organizational development was also behind this.

This project's research activity and output will be divided into two parts. In the first part, I will concentrate on the NRDC's functions, its ownership of patents (which is my most significant discovery from this project.) In the second part I look at the impact its financial support had on accelerating the developing IT industry and I will have three examples in this part:

- Ferranti Mark I*[4]
- Elliott 401[5]
- Ferranti Pegasus[6]

I chose these three computers for specific reasons: the Ferranti Mark I and Ferranti Mark I* established a linkage between the industry and academia and were also the world's first commercially available computers; the Elliot 401 was a small-scale computer with substantial commercial success; and the Ferranti Pegasus was the most popular valve computer.

[4] For details and further information about Ferranti Mark I, please see its Wikipedia page: https://en.wikipedia.org/wiki/Ferranti_Mark_1

[5] For details and further information about Elliott 401, please see: https://www.harpenden- history.org.uk/harpenden-history/topics-cms/businesses_trades_employment/scientific-work/the-elliott-401- computer-at-rothamsted

[6] For details and further information about Ferranti Pegasus, please see its Wikipedia Page: https://en.wikipedia.org/wiki/Ferranti_Pegasus

About the NRDC

The idea of establishing the NRDC had started before the Second World War, but the need for Government-supported research to help the struggling post-war UK industry finally led to the establishment of the NRDC in 1948. It was headed by the Earl of Halsbury as the managing director, with the support of the Board of Trade, the Treasury, and other departments, and was enshrined in law by the Development of Inventions Act of 1948.

To perform its functions, it had the power to borrow up to £5,000,000 from the Board of Trade and was required to repay the money.[7]

There were two main functions of the NRDC. First, it fostered the development and exploitation of new ideas from government-funded research to ensure that expenditure of public funds was in line with the public interest; second, it licensed publicly funded inventions and, where necessary, acquired rights to privately funded inventions.

In April 1948, according to the Development of Inventions Act, the National Research Development Corporation had these functions:

- Securing where the public interest so requires the development or exploitation of inventions resulting from public research and any other invention which it appears to the Corporation that it is not being developed or exploited or sufficiently developed or exploited.

- Acquiring, disposing of, and granting rights (whether gratuitously or for a consideration) in connection with inventions resulting from public research and, where the public interest so requires, in connection with inventions from other sources.[8]

[7] John Crawley, NRDC's role in the early British computer industry. *Resurrection, the Bulletin of the Computer Conservation Society*, issue number 8, winter 1993, 25–32.
[8] The Development of Inventions Act 1948. The provisions of this Act have been amended and consolidated by the Development of Inventions Acts: 1954, 1958, 1965, and 1967.

Later in that year, the Development of Inventions Act 1948 specified the functions of the NRDC as fourfold.

One was the administration of public sector patents: "acquiring, disposing of and granting rights…in connection with inventions resulting from public research."

The second was the active exploitation of the patents: "securing where the public interest so requires, the development or exploitation of inventions resulting from public research."

Thirdly, it acquired and administrated patents from inventions outside the public sector which were in the public interest.

Lastly, the active development or exploitation of any such inventions the NRDC deemed fit: "the development or exploitation…of any other invention as to which it appears to the Corporation that it is not being developed or exploited or sufficiently developed or exploited." [9]

The concept of the Corporation at that time was based on the importance of patentable or patented inventions.

Its first licensing arrangement was fixing an option agreement with IBM for a license in early 1950. It was successful, gaining profits from American firms and justifying the NRDC's actions by showing that it could do something in support of national industrial interest.

The NRDC's efforts on patent owning were not always smooth. According to the NRDC patent pool archives, the NRDC received a strong objection from English Electric Ltd that the NRDC might offer to act as an agent for licensing UK patents owned by the US companies or might assist the US companies in the exploitation of their UK patents. This objection was vitally important, but the meeting note did not record it.[10] (UK manufacturers were in business as purchasers of the UK patent rights from the US owners and as licensors of patents so purchased,

[9] Ibid
[10] Extract from NRDC Board Meeting, 26 February 1958, in NRDC file C/5.3/7.1: 29/13.4

and therefore action by the NRDC might quickly spoil this market.)

Meanwhile, a representative from Ferranti Ltd made the point that British manufacturers who might take a pool license would, in general, be anxious to secure freedom through the pool license in respect of all the UK patents which might be involved in the field of the license. And therefore, irrespective of how the rights might be brought into the pool, it would be desirable for the pool to acquire, whenever possible, the UK patent rights of the foreign ownership.

But from the perspective of the NRDC, the attitude to patents and royalties would not be so inflexible as might have been assumed. If a pool were created which made a realistic assessment of the values of patents, the Corporation would, in general, be prepared to pay the pool royalty so long as the constitution of the pool was such that in the event of the Corporation becoming an extensive user or of any other exceptional circumstances arising, the royalty payment required by the pool could be limited or reduced.

By the end of 1949, the NRDC held around 40 computing patents arising from public research, and this had increased to more than 2,000 by 1957.[11]

The NRDC became directly involved with the computer industry by placing contracts; its first, in 1951, was between Ferranti and Manchester University, with an investment of £400,000.

In 1953 Elliott Brothers were contracted but the project was later transferred to Ferranti for £500,000. This contract resulted in Pegasus.

In 1957 the NRDC created a Patents Pool for the everyday use of the British computer industry.

During the 1950s, computer development was the most critical aspect of the NRDC's activities, spending in 1954 £325,000 out of its £928,000 budget on computers. Around 1960, after advice from the Government, the Corporation withdrew from mainstream computer activity.

The total income from patent exploitation activities received up to 1961 was approximately

[11] Annual Reports of the NRDC, NAHC/NRDC/C49

£370,000, and after deduction of expenditure and revenue sharing payments, a net income approaching £100,000 remained. [12]

All completed projects authorized from 1950 to 1975	Authorized	Investment	Recovery	Gross Surplus	Administrative and other costs	Net Surplus
	£ 9,535,313	£ 6,184,458	£ 8,972,105	£ 2,787,647	£ 487,857	£ 2,299,790

Table 1: Gross and net surplus totals, 1950 - 1975 [13]

	Numberof projects	Showing gross surplus		Showing net surplus	
		Number	%	Number	%
Early projects (1949-1960)	7	1	14	0	0
Projects authorized in 1964 or later	13	8	62	7	54
Total	20	9	45	7	35

Table 2: Proportion of projects[14]

Gross surplus = Recovery minus Investment

Net surplus = Gross surplus minus Administrative Expenses

A Personal Memory of the NRDC:

"It was not obvious how to do things in computing because there wasn't much happening. But, being a precocious, nerdish type, I read The Times. They had little advertisements in the

[12] John Crawley, Review of computer project 1950-1975, ECR 2 88 (xvi) 9.7.1975, NAHC/NRC/C48/4
[13] Ibid
[14] Ibid

personals section for NRDC, the National Research Development Corporation, which was the thing that was promoting computers because it had been set up by Churchill after the Second World War because of his knowledge about Bletchley Park. He thought computers were going to be extremely important. But he didn't want to do anything very overt about it, so there was this company set up to finance the development of computing, basically. It had a wider brief than that, but computing was the essential thing. And so I wrote to the head of the company, it was Lord Haldane [Halsbury], and said, I'm interested in computing, what do I do?"[15]

[15] Iann Barron, Interviewed by Simon Quicke, 22 November 2016, Copyright: Archives of IT.

Ferranti Mark I*

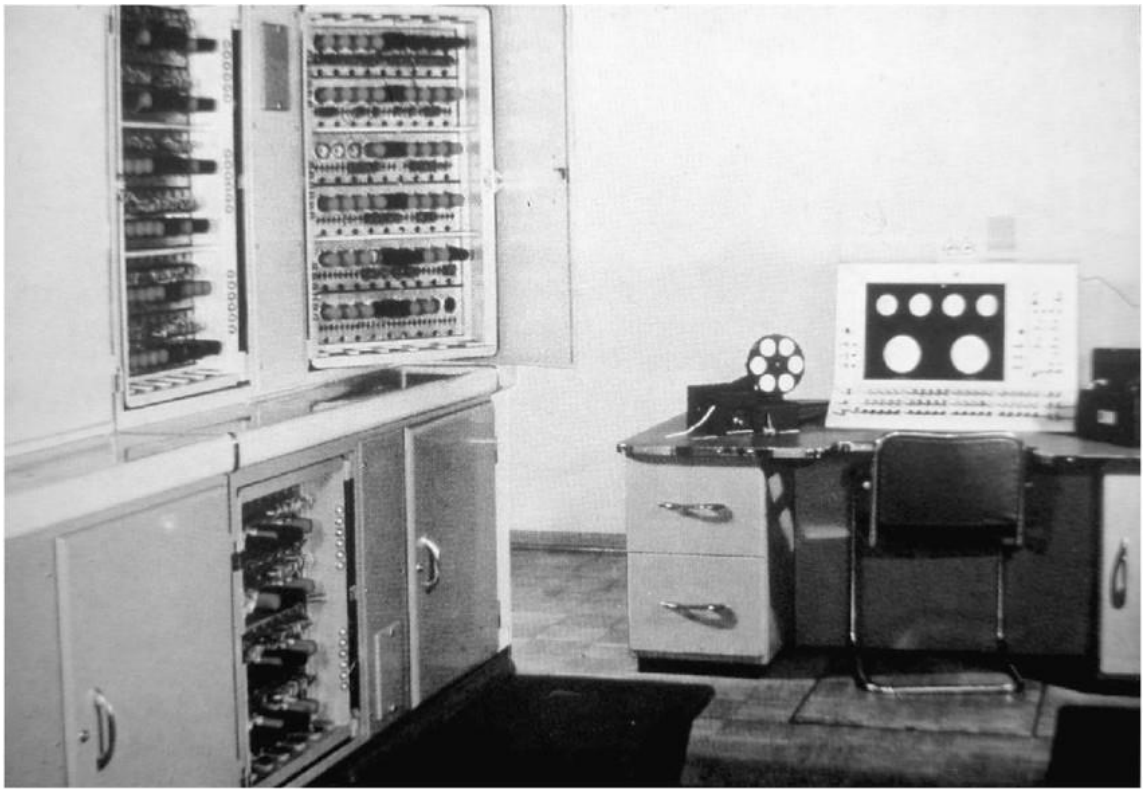

Figure 1: Ferranti Mark I* and its console on the right
Image courtesy of the University of Manchester

During this project, the NRDC mainly engaged with the construction of six Ferranti Mark I* machines which were similar to the two Ferranti Mark I that were already manufactured. (These were the computer installed at Manchester University and a machine to be sold to the Canadian National Research Council for Toronto University.) The six machines built for the NRDC were numbered 4-9. The third machine, a Ferranti Mark I, and the fourth machine, the first Ferranti Mark I*, were made for the Ministry of Supply.[16]

The NRDC first approached Ferranti in February 1951, when the design of the Mark I* had been finished and they were waiting to put it into production. Meanwhile, Lord Halsbury had

[16] John Crawley, The National Research Development Corporation Computer Project. NRDC Computer Sub-Committee paper 132, February 1957. NAHC/NRDC/C2

been trying to convince Ferranti management to produce commercial computers. By then, the NRDC held the administrative rights of the Manchester University computer patents, upon which Ferranti's product depended. The NRDC proposed to sponsor the construction of four Mark I* computers and after a debate on the conditions of the loans and the precise percentage royalty to be split between NRDC and Ferranti, they finally reached an agreement in December 1951[17]. It cost Ferranti 7.5% of their profit and they were to act as the Corporation's agent for resale on a commission basis.[18] The number of computers ended up as six instead of four.

The contract was later extended to the manufacture of nine production machines, to be purchased by the NRDC for resale by Ferranti - substantially on the terms used for the Mark I* contract, with a cost to the NRDC of £220,000 (later £250,000).

In the beginning, Lord Halsbury wrote to the Board of Trade and tried to assign the destination of the first four Ferranti Mark I*, which he named NRDC 1-4.[19]

NRDC No. 1: "to be installed at Ferranti's on indefinite loan, to be used by them for user Research.".

NRDC No. 2: "to be earmarked for the Ministry of Supply who are trying to make up their minds whether they can afford it or not".

NRDC No. 3 & 4: "to be earmarked for British Universities. Leeds and London might be suitable centers, as might Oxford."

As we can tell from Halsbury's expectations, Ferranti's marketing endeavors would be directed at the scientific and academic areas but exclude business and commerce.

Let us compare the actual destinations of the first four Mark I*s.[20]

[17] Ibid
[18] Ibid
[19] Letter dated 27 December 1951 from Lord Halsbury to A.ff Dakin at the Board of Trade, Computers, Manchester University/Ferranti Development, Vol. 1, reports (1951–52), NAHC/NRD/ C7/5
[20] Note of a meeting on 13 December 1954 attended by Pollard, Sions & Swann for Ferranti and Hennesey, Crawley for NRDC. The purpose: to consider "development recoveries in connection with commercial exploitation by Ferranti of digital equipment developed under [MOS] contract No. 6/WT/4890 and its successors". NAHC/NRD/C9

DC4 (NRDC 1) Now subject to a firm order (presumed Shell)
DC5, (NRDC 2) Ministry of Supply (MOS) ordered this one (presumed for Fort Halstead)
DC6, (NRDC 3) Now subject to a firm order (presumed Rome)
DC7, (NRDC 4) MOS has ordered this one (presumed for AWRE)

In September 1953, the NRDC placed an order for another Mark I* (NRDC number 5), and in 1954, a further one (NRDC 6). The NRDC's view was that "The decision to have the sixth, and final, machine manufactured was based upon the fact that the production schedules of Ferranti Ltd. for other equipment were such that a gap existed which could only conveniently be filled by the manufacture of the ninth computer."[21]

The first Ferranti Mark I* was delivered in 1953, and the last one was delivered in 1957.

Mark 1* COMPUTER Ferranti Limited 1951/1952	Authorized	Investment	Recovery	Gross Surplus	Administrative and other costs	Net Surplus
	£ 401,900	£ 401,900	£ 471,500	£ 69,600	£ 80,380	£ (10,780)

Table 3: Ferranti Mark I* Project, 1951/2[22]

The NRDC paid for the manufacture of six machines. All of them were sold and performed useful work.

[21] Crawley, The National Research Development Corporation Computer Project.
[22] Crawley, Computer Sub-Committee paper 132

Elliott 401

Figure 2: Elliott/NRDC 401 Computer c.1953

The Elliott 401 was the NDRC's attempt to develop small-scale and commercially available computers.

Starting in August 1950, the NRDC had contacted the research laboratory of Elliott Brothers Ltd and conducted a series of negotiations about producing a smaller, cheaper machine that could complement the expensive supercomputer Ferranti Mark I*, which served only a tiny percentage of the market.

The NRDC Board held several meetings in 1952 to discuss the contract with Elliott Brothers; it gave authority for expenditure, later extended to £25,000 under the NRDC's agreement with Elliott Brothers to cover the cost of constructing a prototype machine, embodying various techniques proposed by Elliott Brothers, subject to a liability to pay royalties to the Corporation

under license. The final contractual specification of the small-scale machine was agreed upon on 12 December 1952.

The Elliott 401 was a small prototype machine; it was more commercially viable being priced at £20,000.

However, in order to reach out to a larger market and eventually make more profit, the NRDC did not recover its costs on the Elliott 401 project. The expenditure by the NRDC associated with the Elliott 401 amounted to approximately £62,000. However, it received a development recovery of £21,000, £2,000 of rental fees, yielding a return for 11 years life of £22,000, plus some other incidental income. So for an expenditure of £62,000, with a return of about £44,500, the NRDC lost £17,500 on this project.

Elliott 401 Computer	Authorized	Investment	Recovery	Gross surplus	Administrative and other costs	Net surplus
1953/54	£ 61,967	£ 61,967	£ 44,547	(17,420)	12,393	(29,813)

Table four: Completed Elliott 401 project

Note: The NRDC paid for the development of the computer and recovered some costs partly via renting a machine to Rothamsted Experimental station and partly from sales made by Elliott Brothers.

Ferranti Pegasus

Figure 3: Ferranti Pegasus 1959

By November 1953, the NRDC had decided to build the Pegasus, a medium-scale, low-cost package computer with Ferranti Ltd.

At the very beginning, the contract had been drafted as having all rights generated by the Pegasus development passed to the NRDC, and the NRDC would have a right to veto any changes to the design from the original specification. Also, Ferranti could not sell any of its computers that directly competed with the Pegasus. Before the NRDC sold its ordered Pegasus, Ferranti could not offer any of the Pegasus for sale.

This frustrated Sir Vincent de Ferranti; after arguing for change, he succeeded in removing the right of veto. As a result, the NRDC placed the contract with Ferranti in November 1953 and December 1954.

After two years of the first contract, the Ferranti Pegasus first ran a program in October 1955 and was first used by external customers in April 1956.

During the project, the cost went beyond the NRDC's budget, which for the whole operation was £220,000. By 1956, the Pegasus project had spent £300,000 from its two laboratories (£180,000 at the London laboratory and £120,000 at the Oldham facility) but this was for just seven of the nine machines.

There were 40 Ferranti Pegasus computers in total built during the project and all were sold between 1956 and 1962.

By the year 1958, the NRDC had paid out £513,575 to Ferranti under this contract but only received income of £311,930 from selling the Pegasus computers; even with an ex gratia payment of £75,000, it still lost more than £140,000.[23]

Pegasus Computer	Authorized	Investment	Recovery	Gross surplus	Administrative and other costs	Net surplus
Ferranti Limited 1954/55	£ 513,600	£ 513,600	£ 389,600	£ (124,000)	£ 102,720	£ (226,720)

Table 5: Ferranti Pegasus Project, 1954/55

The Ferranti Pegasus machines were used for many years and substantially contributed to the industry's growth.

Personal memories of Pegasus:

Science Museum

Two Ferranti Pegasus have survived and are on display in museums, one in The Science Museum (London) and one in The Manchester Museum of Science and Industry. Curator Doron Swade from Science Museum (London) recalled: "Ferranti Pegasus was one of the first, if not the first, it may have been the first, computer we chose for restoration to working order…I

[23] Extract from NRDC Board Meeting, 26 February 1958, in NRDC file C/5.3/7.1: 29/13.4

think Pegasus was the first major machine that we restored to working order. There's another significance to Pegasus, particularly to the Computer Conservation Society. Pegasus became the flagship project for the society because we didn't know whether you could restore these things to working order and we did, we succeeded. And so it was a huge staging post of credibility and confidence that this programme of restoring old machines to working order was viable. So it was terribly important. You know, Pegasus, there's a special affection between CCS and Pegasus because it was the first and it proved that we weren't completely off beam."[24]

Industry:

"At one stage we were between testing aeroplanes and I had a month's secondment to Maths Services, and there was a Ferranti Pegasus thing. I mean it's a proper computer."[25]

[24] Doron Swade MBE, Interviewed by Elisabetta Mori, 8 May 2019, Copyright: Archives of IT
[25] Sir George Cox, Interviewed by Alan Cane, 28 September 2018, Copyright: Archives of IT

Conclusion:

As an entity, the NRDC did succeed in its economic returns; its overall net surplus was nearly £2,300,000 in 25 years and more than half of its individual projects showed a net surplus. However, the projects in the early years of its establishment, from 1949 to 1960, were mainly in deficit. It seemed that the NRDC operated as a national organization, which tried to favour the production of computers but perhaps did not consider carefully enough the balance between establishing a market and making profits. In the cases above, all three failed to make any profit, and the negotiation process was not smooth going; the companies did not always welcome the support of, or contracts with, the NRDC.

However, it did popularize the utilization of computers, and made them commercially available; it was a catalyst for the production of computers on various scales and which served different purposes, applying computers in multiple disparate areas, all of which increased productivity through this period.