

# The Entry of Established Electronics Companies into the Early Computer Industry in the UK and USA

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It seems obvious that when a new product is developed which is based on technology already used in an established market, that the firms already using that technology will have a number of advantages in the new market. Evidence from the 1950s and 1960s campaign by electronics firms to dominate the emerging computer market shows that this observation is not always true. The corporations with the most extensive knowledge of the technology needed to build computers failed against firms which had to build up these techniques from scratch.

If the economies of scale and scope are real competitive advantages then the electronics firms should have been well positioned to exploit them in the computer industry. Instead, by the early 1970s, all of these firms, bar Honeywell, had abandoned commercial computer manufacturing. Instead the industry was dominated by the smaller firms which had previously built electro-mechanical punched card office automation systems and by start-up companies.

## Dissertation Approach

The aim of the thesis was to explore the factors contributing to success or failure in the new industry. The study followed a traditional route relying heavily on case studies with archival sources as the raw material. The main electronic corporations studied included some of the most famous industrial names in Britain and America:

US: RCA, General Electric

UK: Ferranti, EMI, English Electric

These examples are contrasted by shorter case studies on the successful firms in the early computer industry, if success is measured by survival:

US: IBM, Burroughs, NCR, Sperry Rand, Honeywell, CDC, DEC

UK: ICT

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## **Entry of Electronics Firms into the Computer Industry: Exploiting Economies of Sale and Scope.**

Before discussing why the electronics firms failed in the computer industry we have to understand what attracted them to it in the first place. The timing and circumstances of market entry are closely related to the development of the computer industry. This development is usually divided up into generations:

First generation machines were built from the late forties to around 1957/8 and were based on the pre-war vacuum tube technology. The first machines of this generation were mainly experimental systems used in science. The latter part of this generation saw computers becoming much more reliable and sales starting to take off with the IBM 650 series selling over 1000 examples, mainly replacing punched card office automation systems.

Second generation machines were built in the late 1950s to the mid 1960s using solid state transistor components. They were even more reliable and started to replace electro-mechanical systems on a large scale in commercial automation. The IBM 1401 series sold over 10000.

Third generation computers came next and were mainly built using integrated circuits. However, the real difference was the availability of whole families of compatible systems which allowed the same programs and data to be run on both small and large scale systems. This meant firms could develop their computer operation without losing programs and could run a mixed bag of systems to suit the size of different operations. The IBM 360 was the archetypal 3rd generation family.

All the electronics companies joined the industry with the idea that they could exploit their ability to mass produce other forms of electronics and gain both scale and scope economies in the rapidly developing market for computers. Ferranti was the first electronics firm to enter the industry. In the post-war years its electronics team was running out of work elsewhere and adopted computers to get through this lean period. The other electronics companies made their major bid to enter the industry at the cusp of the first and second generations of computers. At this time it was becoming obvious that the industry had enormous potential as demand for computers started to spread into every area of commerce. The electronics firms each tried to take advantage of the knowledge they had of using solid state digital technology in other fields, mostly in their work for the military. This gave them a big advantage in entering the new sector as it greatly lessened the barrier to entry that they faced.

The business machines firms had a different rationale: they either had to build computers or die. During the second generation of computing they found that the market for traditional punched card systems was drying up as computers were taking their place. They had market knowledge, but had little experience in electronics. To build up skills in electronics and computing they acquired smaller computer operations. These came from two sources, in America they mainly bought small start-up computer firms while in the UK ICT bought the failed computer divisions of the British electronics firms. IBM was the exception, where the skills were home grown. IBM was a major supplier of calculation systems to the science and military communities and this led it to computing

much earlier. It was also using electronics to improve the performance of its old punched card systems.

### **Why Did the Electronics Firms Fail?**

The main finding of this dissertation was that there is no monocausal explanation for the failure of the electronics firms in the computer market. Rather an explanation should be sought in a series of inter-linked problems which together we might describe as the dis-economies of scope.

#### **1) Capital Allocation**

The factor which eventually forced all the electronics firms out of the computer industry was the problem of being involved with so many high technology industries and the competition for funds that this created. All of the electronics firms maintained a portfolio of high technology products. An example was RCA. RCA was developing computers at the same time that it was building up its color television operations, trying to develop a semiconductor business and undertaking a whole range of military and space diversifications. All these were very expensive things to do: the color television effort alone not only required the building of facilities to make televisions, RCA had to build the cameras, develop the transmitters and make the components and this was very capital intensive. GE faced a similar problem. During the late 1960s and early 1970s it was trying to develop its computer business. Simultaneously it was developing a new commercial jet engine business and while it was building nuclear power stations at the rate of half a dozen a year.

This dispersal of resources had two specific effects on the computer division of these firms: Investment in computers was dependent on the capital demands of the rest of the company. As will be explained below, computers were not seen as a core business by the senior management of the electronics firms and therefore investment was rationed by the demands of the other product lines. This meant that investment in the computer division tended to be out of step with the overall development of the computer industry. For example, RCA increased or decreased investment in computers according to how much investment was needed by its television operation. RCA failed to develop new computer techniques when the market demanded them and then, as capital became available, pumped huge sums into building up market share just as computer technology was about to move into another generation, negating the investment made in the older technology. Investment was not made according to the demands of the market, but according to the availability of capital within the corporation.

As the computer industry became bigger the amount of investment required to compete increased. A range of first generation machines in the early 1950s may well have been regarded as a success with sales of just a few dozen. By the mid-1960s the third generation computers were selling in thousands. Each upward step required much greater investment. The same was true in most electronic and electrical products. If two major developments coincided the resource requirements were huge.

## 2) The status of the computer division

When faced with periods of capital rationing it was often the computer division of these firms which faced the most severe restrictions on investment. One major factor was that the computer product champions were relatively junior personnel. The first computers built by these firms were born out of a small unit within just one division of the overall corporation. In the cases of both Ferranti and EMI it was management in the electronics division trying to diversify from military work that led to the building of commercial computers. At GE it seemed to come about because of the stubbornness of one middle manager, Barney Oldfield. Only at RCA did computers have a product champion at the top of the company. This was the young Bobby Sarnoff, son of "General" Robert Sarnoff the chairman of the company. Bobby supported computers and when he took charge of the firm he put money into the operation. However, in a similar fashion to the problems caused by capital allocation variability, Bobby's investment in computers was mis-timed. He invested in old technology just as it was about to be replaced.

Supporters of other technologies, such as power generation or military electronics, sat on the boards of these companies representing the interests of the older divisions. Managers who had developed these operations had become senior within the company. It is not, therefore, surprising that computers were not seen by these companies as a core product, but only as a possible diversification to be invested in when possible.

In the business machines companies the product champions were at the top. Excluding the famous case of Tom Watson, Jr., who adopted computers very early, it seems that senior managers in the business machines firms were forced to support computers finding that computers were replacing their old products. They had to build this new technology or die. Another important factor was that most business machines companies expanded into computing via acquisition. Such decisions had to be made by the top personnel within the firm.

Computers became the major focus within business machines firms. This is where Honeywell differed from the other electronics companies. By 1970 computers made up 50% of Honeywell's turnover. At RCA and General Electric computers barely made up 5-10% of turnover. This may have made the computer operations of the larger GE and RCA as large as Honeywell, but management commitment to it was low.

## 3) Low emphasis on sales

There was a major inability within many of the electronics companies to identify the computer as a product that needed a massive sales and marketing effort. These firms were more used to selling to a limited number of government agencies, utilities, or specialist enterprises. The one area in which they did have a mass market was in consumer electronics. However, in this area they were not vertically integrated: retailers took responsibility for selling the consumer products of the electronics companies.

The business machines firms had thousands of salesmen from the electro-mechanical days. IBM and NCR saw sales as their main function, it was

only by having an effective sales forces that the rest of the vertically integrated corporation could be kept busy. These systems were sold directly to thousands of commercial customers all over the world. Electronics firms placed barely enough effort on development and manufacture and very little on sales or even to listening to the demands of the market place, something that the business machines firms were used to doing.

#### 4) Financing computer sales

One of the great problems with the mainframe computer industry of the time was that very few firms bought systems outright. Most customers leased computers, mainly from the builder themselves. The electronics companies were, however, used to selling the results of their development and manufacturing efforts outright. Having income from its products spread over a number of years was a different situation requiring much more planning of resources.

The best example of the problems this could cause was at RCA. In the late 1960s Bobby Sarnoff decided to build up market share in electronic data processing by offering cheap leases on its Spectra series of IBM compatible computers and giving customers an option to replace these machines with new ones when they became available. The firm managed to place hundreds of new machines with customers and became number two in the industry after IBM. RCA was caught offguard by the announcement of the IBM 370 family in 1970. These machines offered new features and much better price/performance ratios. RCA had to react and released the RCA Series. Spectra users saw that this new range was better and sent back the old Spectra machines for the new ones. RCA was devastated; it had been writing leases in the books as completed sales, taking the whole profit of the lease immediately. Suddenly hundreds of half depreciated machines came back leading to losses of hundreds of millions of dollars. This ended RCA's foray into computers.

#### 5) Failure to exploit the economies of scale and scope

Undoubtedly, exploiting the economies of scope was a key element in the entry of the electronics companies into the computer market. Their ability to build electronic instruments did lower the barriers to entry to the new market. However, after the initial diversification the organizational philosophy of operating separate profit centres led to the building of barriers between related divisions. The electronics firms built computers for a number of purposes, for the military, for industrial control as well as building stand-alone commercial computers. These systems were produced and sold in almost total isolation from each other; there was little room for sharing resources.

The one area of commonality that did remain was an overt policy of vertical integration where the computer division was expected to buy the majority of components from in-house manufacturers. This was a great disadvantage. In general the large electronics corporations were losing the electronic components market to new specialist firms like Texas Instruments, Motorola and Fairchild. They were also faring badly in computer sub-systems such as memory systems and electro-mechanical peripherals. The computer divisions of RCA, GE, and

English Electric were locked into buying from the declining forces in the industry.

### **Summary**

The advantages of scale and scope that these firms were trying to exploit were not enough to make them succeed in this market. Indeed, apart from lowering the barrier to entry, these advantages had little relevance. Instead they faced the overwhelming effect of the dis-economies of scope. If possible they would have liked to have dominated this sector as they had other areas of electronics, especially as it was the fastest growing sector of the electronics industry. However, poor organizational structures, competition for funds and lack of market awareness counted against them. In the business machines firms components came from the best possible source and the whole firm was integrated for one purpose, that of building and selling mainframe computers to commercial customers.