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**COMPETITIVE STRATEGY  
AND THE IMPLEMENTATION  
OF A NEW NETWORK TECHNOLOGY  
- THE CASE OF EFTPOS IN THE UK**

**John Howells and Jim Hine**



**UNIVERSITY OF EDINBURGH**

## The Working Paper Series

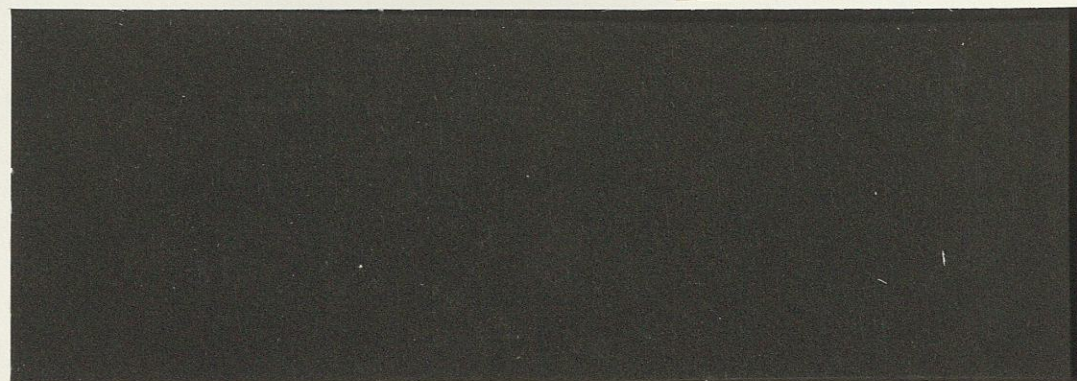
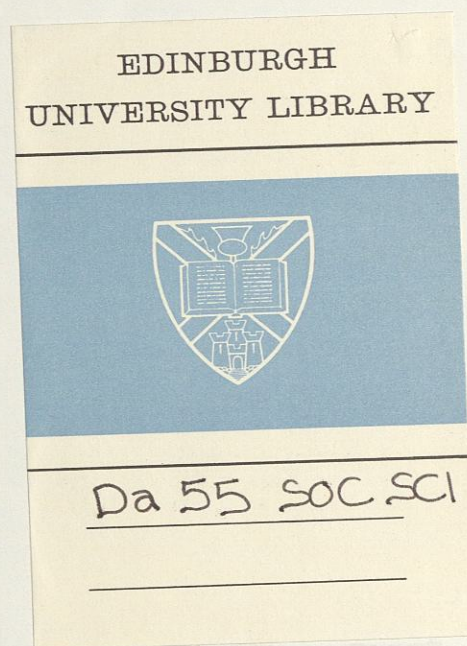
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## Edinburgh PICT Working Paper No. 26

### COMPETITIVE STRATEGY AND THE IMPLEMENTATION OF A NEW NETWORK TECHNOLOGY - THE CASE OF EFTPOS IN THE UK

John Howells and Jim Hine

1990

This article arises from an investigation into the development of Electronic Funds Transfer at Point of Sale (EFTPOS) funded by the ESRC/ESRC Joint Committee Initiative on the Successful Management of Technological Change, and based in the Department of Business Studies, Edinburgh University.

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Introduction

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1 Introduction

In the 1970s the "cashless society" was heralded as a society of the near future where plastic cards would replace cash and cheques and every retailer would have electronic terminals to read the cards. This was EFTPOS, electronic fund transfer at the point of sale, but it was not until the late 1980s that the banks began to invest in the network infrastructure that could begin to make the cashless society a reality. The possibility of EFTPOS grew as microchips, terminals and mainframe computer processing power became cheaper in the 1970s and 1980s. The UK banks first examined EFTPOS as long ago as the mid-1970s, but it was not until 1984 that they started to discuss how they would work together and to create a project team to work on its technical feasibility.

One of the spurs to action in 1984 was Cresta Communications' EFTPOS experiment in London. This small company had established an EFTPOS service that was popular with retailers and that was completely off-line. The only role for the banks was to supply hot-card files which could be down-loaded to Cresta terminals. EFTPOS was threatening to move out of the banks' control. Fortunately for the banks, Cresta was owned by British Telecom, so when the banks began to develop the EFTPOS UK system in conjunction with BT, BT saw no need to develop two systems in parallel and so abandoned the Cresta network.

The investment required to produce a national EFTPOS network has been quoted as being of the order of billions of pounds (Whitehead 1990) depending on the sophistication of the network that is built. Such a national system would link the estimated 300 000 retail outlets in the UK that could take EFTPOS terminals (Woodman and Diver 1988). The gains promise to be large, since over half of a clearing bank's costs are money transmission; this is the cost of collecting and processing paper recorded transactions. Woodman and Diver (1988) suggest that cheque clearing costs in 1987 were 50p per item while an EFTPOS transaction cost 15p. Bank figures give 2.2 billion cheques cleared for 1988, (APACS 1989). So the annual savings that would arise from replacing a cheque clearing with an electronic clearing in the UK are of the order of £800 million. Exact calculations are ruled out because until the paper clearing infrastructure

can be completely closed down it must be run at great expense in parallel with an EFTPOS clearing.

The aim of the study reported here was to elicit from bankers what they considered the important influences on the creation of an EFTPOS network in the UK and to analyse how bank managers arrived at their views. EFTPOS was chosen because the method of introduction of the electronic network would radically alter inter-bank and bank-retailer relationships - these relationships were controlled through a paper based transaction exchange system that EFTPOS would replace. In 1988 when our research began it appeared that the UK banks had indeed chosen to use EFTPOS to significantly change the relationships they had with customers and retailers.

## 2 Method

In our view the best method for developing an understanding of what the banks considered important events and influences on EFTPOS was the method of developing grounded theory (Glaser and Strauss, 1967) from semi-structured interviews, (Hickson et al, 1986). One of the objects of initial interviews was to build up an "event schema" (Pettigrew, 1979) which would lend greater structure to later interviews. Managers could then be taken through the key events and asked to describe the different influences on these events.

Forty five managers were interviewed from 10 organisations in the banking, retail and EFTPOS equipment supply industries concerned with the development of an EFTPOS strategy. Some interviewees were interviewed more than once and became regular sources with whom we were able to discuss informally many features of EFTPOS development. The interviews were recorded and transcribed; grounded theory categories were then built up through transcript analysis. The major categories were as follows:

### COMPETITION AND COOPERATION BETWEEN BANKS

### THE EVOLUTION OF THE BANK-RETAILER-CUSTOMER RELATIONSHIP

### THE MANAGEMENT OF THE EFTPOS UK ORGANISATION

## PERCEPTIONS OF SECURITY

## ORGANISATIONAL MEANING OF NETWORK STRUCTURES

In our analysis, fluxing cooperation and competition between banks emerged as a major category, indeed a theme which conditioned many important features of the evolving EFTPOS networks. This paper focuses on this theme and presents our analysis of the role of competition and cooperation in the development of EFTPOS strategy among the UK banks.

### 3 Cooperation

#### 3.1 A history of cooperation to build infrastructure

When EFTPOS was seriously considered in 1985-1986, it was assumed that some form of collectively supported scheme was the natural way to proceed.

*...there was a concern... which was really very undefined, to get a national EFTPOS system going. I suppose it is simply with all the establishment looking on... a need to be seen therefore to serve... the banking industry collectively... able to say to the Bank of England as the central bank, 'look, we are doing it collectively, we are a member of this club.'*

EFTPOS UK<sup>1</sup> was the jointly owned organisation the banks set up to pilot and develop the national EFTPOS system. Each of the banks would have an equal vote on the EFTPOS UK Steering Committee although they would contribute in rough proportion to their size and

*...the whole concept from 1986 on at EFTPOS UK was based on two words which were said to be able to be aligned - cooperating and competition. It was this element of cooperation which gave the environment the atmosphere - you know, the culture of the prep school... there was a degree of clubbery in this and that was the cooperative side.*

The other clearings in the UK, such as CHAPS, BACS and TOWN, were all collectively owned and regulated through APACS, the clearing banks jointly owned organisation and so,

<sup>1</sup>Money was allocated to some form of cooperative venture in January 1985 while the organisation given the responsibility to work on this was called EFTPOS Holdings Ltd, renamed EFTPOS UK in April 1987.

...it seemed logical that EFTPOS should be self regulated in a similar manner.

However, there had been a trend for the banks to allow themselves greater freedom to act competitively within the various collectively owned EFT systems, as one by one these were designed and implemented during the 1970s and 1980s. This was particularly noticeable in the attempts to design CHAPS collectively:

*the first Chaps project, the electronic same-day clearing was designed as a large piece of commonly owned infrastructure and rather in a sense like EFTPOS UK, that collapsed, and what emerged was a second version which was much more decentralised, very little commonly owned infrastructure and banks simply connected up via the Telecom PSS network; and in that way the banks saw that they could provide a much greater variety of service to their customers*

The example of CHAPS showed that the EFT clearings could be designed and constructed to allow different degrees of bank competition. The banks approached EFTPOS in the way they had approached other banking industry technology; they assumed a cooperative approach to EFTPOS design was best and that interbank competition could be "built" in to this design. However, the banks would be required to agree on what "competition" would mean in an EFTPOS environment.

### 3.2 Cooperation to share the costs of common infrastructure

One reason why the banks were discussing EFTPOS as a cooperative venture was because,

*none of the banks feels... they can possibly afford to go entirely on their own. You can't do EFTPOS, you can't do any money transmissions on your own, its a ridiculous concept. It is a way of exchanging data with your competitors: you have to have a forum.*

To "clear" a transaction a bank needed to pass transactions collected from its retailers to "rival" banks who held the personal accounts of the retailers' customers. There had to be an element of cooperation in EFTPOS design, if it was only to decide on communication protocols for clearing. However, the degree of cooperation could be much greater than simple agreement on communication protocols. The banks saw that, providing costs were shared, a more technically sophisticated system could be built: one

that used the RSA algorithm to encrypt transactions at the point of sale and provide an audit trail for each transaction.

The total costs of EFTPOS would be large since they were building a system that would substantially replace the use of paper; a national system consisting of some 300 000 terminals in retail outlets plus the communications and computer processing power to manipulate collected transactions. By working together they could hope to share this "infrastructure" cost.

### 3.3 Cooperation to Decrease Bank Costs

By replacing cheques, cash and other forms of paper money transmission, electronic funds transfer offered to decrease banking costs enormously. Trench neatly summed this up,

*the strategy is to get rid of paper and to remove the cheque and all the costs associated with handling that<sup>2</sup> ...there are a 101 different varieties of getting there.*

This motivation was linked to a clear view of EFTPOS as primarily the banks' business and something which would and should primarily benefit the banks since they bore the brunt of processing paper transactions. This view led to a reluctance on the part of most banks to allow retailers power in the design of the national system.

### 3.4 Cooperation to present a united front to retailers

The national system was criticised by retailers individually and by the Retail Consortium<sup>3</sup> as being devised to advantage the banks and not the retailers. The banks resented the retailers' criticisms and their right to criticise,

*...obviously there were fairly strong views among some of the member banks: they didn't want the retailers to have any sort of feeling*

<sup>2</sup> Over 50% of bank operating costs are the costs of money transmission, while as suggested earlier, EFTPOS transactions are cheaper than paper transactions by a factor of approximately a fifth.

<sup>3</sup>The Retail Consortium is the retailing industry's pressure group and contains most large retailers.

*that they were in control of this activity which was the banks' business.*

There were arguments over the degree to which retailers were consulted for the duration of the national EFTPOS project, with retailers criticising the fact that they did not control the design and choice of key features of the network and the banks claiming they had no right to do so.

#### 4 Intensification of competition

The highly cooperative approach to building an EFTPOS network was eventually abandoned. It was not a gradual process, but one accomplished in a number of "steps" over a period of one or two years. The issue of the Connect card and the development of Switch, outlined below, came to be seen as key events difficult to reconcile with the idea that the banks were all committed to developing the national system. These events became pivotal in each bank's new interpretation of its competitive environment. This was seen as more uncertain and more competitive at the same time as the banks made public protestations of commitment to EFTPOS UK and the development of the national service. It was at first unclear whether EFTPOS UK should be abandoned, then later it was seen as not politic to abandon EFTPOS UK. Finally, EFTPOS UK was abandoned because the "experimental" EFTPOS networks had developed sufficiently for EFTPOS UK to appear an anachronism. These changes in the banks' perceptions of EFTPOS UK occurred over a period of two and a half years.

##### 4.1 New entrants and the breaking of the informal rules of "the club"

There existed before EFTPOS an informal spirit of a "club" and an established way of behaving between the banks. One manager described how the old established clearing banks worked together,

*we don't all like each other all of the time but there has long been an acceptance of alliances so that we always divide evenly. We always manage to get a balance.*

This changed when deregulation arrived with the Building Societies Act of 1985: Hawkins (a Lloyds Bank card services manager) referred to the shock that deregulation had on the banks at an EFTPOS conference,

*We woke with a jolt to the fact that over the years all banking services had become indistinguishable from each other. (Hawkins 1989)*

In 1984 the Building Society organisation Link had applied to join BACS but the banks had refused to give it access. The building societies had put pressure on the government and helped to produce the 1985 Building Societies Act which allowed building societies and other financial institutions to compete with the banks from January, 1986. The banks were now obliged to give the Building Societies a degree of access to both their paper and electronic clearing networks. They had wanted to appear willing to work with this legislation and so had shown,

*the overriding desire to appear to be open with the clearing system and allow in new members; and they hated themselves and they hated the new members - Nationwide Anglia, Halifax especially - they hated them! ...they are now into the club and you know... their ties are not quite right.*

Despite these strong antagonisms the 1985 Act did not specify the conditions for admission to the clearing networks and the banks themselves were able to set these. They admitted many of these new institutions to BACS, but they limited the number of new building society entrants to EFTPOS UK to three; the Halifax, Abbey National and Nationwide Anglia. This was a disappointment to many building societies who had seen, in the on-line, EFTPOS UK system a means of circumventing the need to produce cheques of their own. The building societies wanted to convert their customers' ATM cards to debit card functionality and then give them access to EFTPOS and by joining EFTPOS UK these institutions hoped to leapfrog paper clearing altogether; they would have been helped by the cooperative, cost-sharing approach of EFTPOS UK. However, as the banks began to turn to more individualistic strategies for developing EFTPOS they continued to disabuse the new members who joined in 1987 of their hopes for the future. One banker commented that whereas the banks had gone in to EFTPOS UK with their eyes open the later entrants were conned.

However, the fact that the building societies were trying and succeeding to be new entrants to the banking industry was not the major reason for the changes in EFTPOS strategy and the abandonment of the EFTPOS UK approach. Rather, it was a change in the perception of how the seven

established banks related to each other that sponsored the move away from a cooperative approach.

It may be significant that the Building Societies were only allowed in to EFTPOS UK when the alternative EFTPOS strategies were beginning to emerge, in 1987. Some of the clearing banks may have seen that EFTPOS UK was becoming less important and so admitting new members was no longer equivalent to admitting new competitors.

The change in the banks' relationships began in the discussions leading up to the publication of the BIS specifications (the Business Inaugural Service, the name for the pilot EFTPOS UK network) for public discussion. The banks had disagreed with Barclays over the choice of encryption algorithm for the EFTPOS UK standard and Barclays had threatened to withdraw from EFTPOS UK if the DES algorithm<sup>4</sup> was not chosen. This was seen as significant by the other banks because Barclays owned one of the pre-EFTPOS UK "experiments" of 300 terminals called PDQ which had been cosponsored by the Committee of London Clearing Banks (the CLCB) in 1985. Barclaycard had used the transaction key implementation of the DES algorithm in PDQ. At this time it was not clear whether RSA and DES systems could be interfaced and some banks were happy with the idea that by choosing RSA for EFTPOS UK, PDQ would eventually become obsolescent. There was also fear that if EFTPOS UK was made compatible with Barclays' system, then Barclays, by developing PDQ independently, could steal a march on the other banks waiting for the EFTPOS UK standards to be finalised. Barclays themselves were suspicious of the technical reasons other banks gave for supporting the RSA decision, but when RSA was confirmed as the EFTPOS UK algorithm Barclays decided to remain as a member of EFTPOS UK.

<sup>4</sup>An algorithm is a set of mathematical operations that scramble a message and which can be reversed easily only if the mathematical "key" is known. The Data Encryption Standard is an algorithm that is used worldwide for the encryption of banking transactions and is used by the UK banks to encrypt transactions that are cleared electronically. RSA is an algorithm that uses a different mathematical property to DES to encrypt information. If an attack is made on an encrypted message the two algorithms have different strengths and weaknesses.

These events, together with the appearance of Connect (see below) deepened the distrust the banks felt for one another and made continued cooperation more difficult. Barclays would even be suspected by more than one bank of remaining within EFTPOS UK simply to ensure that EFTPOS UK failed to produce a viable national scheme. One manager expressed this belief as follows,

*in a sense what has happened to EFTPOS UK is evidence of, clearly, what may have been the motivation to stay in it, which is to prevent the obvious fact that the one way to ensure that something you don't want to see happen happen, is to break yourself away from it and invite all the others to unite. Also if you want to undermine something the best way to do so is from inside rather than from outside.*

Barclays deny that they remained in EFTPOS UK purely to undermine the organisation. However, along with other banks, such as the Midland and Nat West, Barclays acknowledged that fear of what EFTPOS UK might become if they left the organisation was a motivation for not leaving, ie the remaining members of EFTPOS UK might unite and succeed in marginalising whichever bank had left by accelerating and changing the development of the national system. So the extraordinary situation emerged where the largest banks were independently pursuing their EFTPOS ambitions outside of EFTPOS UK, while continuing as paying members until its demise in April 1990. The cost of EFTPOS UK eventually rose to £160 million,<sup>5</sup> when technical development inside banks is included with the cost of the EFTPOS UK activity. However, this cost was shared by all banks and no bank regarded it as excessive for the technical achievements of EFTPOS UK.

#### 4.2 New alliances among the clearing banks

It was difficult for EFTPOS UK to obtain unanimous support for many critical features of the national scheme. The member banks formed sub-alliances within EFTPOS UK on various issues, not just the RSA versus DES issue;

*...another way in which you lined up was the on/off-line debate. Another way you lined up was in how much sympathy you felt for Barclays being naughty boys and how much you felt, you know, we'll teach them a lesson.*

<sup>5</sup>This figure was the one most frequently given by managers.

Perhaps the most important split was based on Barclays' dominant role as a merchant acquirer. A "merchant acquirer" is a bank which collects and clears the transactions from retailers and Barclays was the biggest merchant acquirer, controlling nearly half of all retailer business.<sup>6</sup> Whilst the other banks were not in a position to erode Barclays' large market share under a stable paper-clearing technology, EFTPOS offered the chance to win substantial market share from Barclays. Accordingly, competition had been designed to occur in the EFTPOS UK system in a manner which threatened to prevent one bank from having a dominant position in the merchant acquirer business (see section 4.1 for more comment on this issue).

Towards the end of 1987, the banks finalised the details of the UDCS or Unified Debit Card Scheme which was to be linked to the EFTPOS UK delivery system. Almost immediately afterwards Barclays announced the launch of their own Visa-branded debit card, Connect, which would not belong to the UDCS even though the UDCS had been agreed with all member institutions including Barclays Bank. The effect of the Connect launch was dramatic,

*It fundamentally undermined the UDCS... It brought about two things.. Switch, and as a full consequence the death of EFTPOS UK.*

Connect represented a break with the cooperative approach towards EFTPOS and

*when Connect was launched the retreat and defend reaction of the other members ran deeper because of these two previous instances with Barclays [these were the RSA versus DES argument and the argument over PDQ compatibility with the national system] and lastly, I suppose, but not surprisingly, Nat West and Midland began to think there had to be a better way of doing a debit card than through the UDCS which was no longer unified thanks to Connect and, more so, they would give Barclays a bloody nose for their efforts at the same time. I mean it was as much that and... you still get phrases like 'our pockets are deeper than theirs - come and try us.'*

<sup>6</sup>Partly because Barclays controlled Visa in the UK and through Barclaycard had become the only Visa acquirer of retailers.

Lloyds followed Barclays and issued its own Visa debit card in June 1987, while Midland, Nat West and the Royal Bank of Scotland formed the Switch card scheme with a target of issuing a debit card in April 1988.

*We couldn't wait until the latter part of 1989 to have that (UDCS), given the fact that Connect and the Lloyds payment card had been announced and launched during 1988 so we had to respond and respond very quickly and firmly.*

A split between Lloyds and Barclays, the "Visa banks", on the one hand and the Switch banks on the other was established as two different routes to providing EFTPOS in the UK. The split became evident in the common meeting ground of EFTPOS UK,

*and you had the smaller banks in the middle seeking to keep the EFTPOS UK card Scheme going as a separate entity... trying to preserve its future and all that it stood for.*

Smaller banks had stood to gain most from the EFTPOS UK scheme and struggled longer with their belief that it had a future.

#### 4.3 Slow formation of new competitive strategies

The significance of Connect and the formation of Switch for EFTPOS UK was not at first obvious,

*it was a game and nobody had yet worked out where the end game was going to be. We all knew what we thought it would be... its fine for example Barclays or Nat West, whoever, to say now that they knew in 1987 - what they probably knew was that it might not fly and what they would know was what they'd do if it didn't.*

The Switch banks made their card scheme compatible with the EFTPOS UK Card scheme, which was an apparent signal that they supported EFTPOS UK and neither Barclays, Lloyds or the Switch banks left the EFTPOS UK organisation but continued to support the initiative publicly.<sup>7</sup> These contradictory events made it difficult for smaller banks to decide the

<sup>7</sup>This they continued to do until as late as April 1990, by which time it had long been clear (for 1-2 years) to everyone in the banking industry including EFTPOS UK management, that the experimental EFTPOS schemes had become the banks' real routes to eftpos. However, as described in 3.1, the banks were afraid to leave EFTPOS UK because once they left their competitors might change it into a more formidable scheme.

overall significance for EFTPOS UK. Yousaf described the reactions of these banks,

*as soon as Connect was announced it was apparent that the UDCS could never be united... the concept that the original Task force foresaw no longer applied, but there was a feeling that it could still survive and Barclays might be brought back into the fold.*

Competition between the banks gradually became more defined and more intense in the EFTPOS field, as they searched for a coherent explanation of events such as the issue of Connect and the start of Switch. The focus within EFTPOS UK had been on reasons for the banks to cooperate rather than reasons to compete. In EFTPOS UK this cooperative element was,

*...made fun of and enjoyable through the fact that it was always understood we were competitive with each other anyway in our various areas... there was always an attempt to define what cooperation should be. But there was no attempt ever to define what competition meant.*

Ironically it was through the development of a national EFTPOS strategy and through collective membership of EFTPOS UK that the banks developed their understanding of what competition was,

*...there was so much we got for those costs. A real understanding within particularly the seven clearing banks of how to do things, of the ceiling on cooperation and the cut over to competition. An awareness that when we say competition we mean with teeth...*

The banks had always thought of themselves as "competitive," but now competition was being redefined as the banks realised that the design of their EFTPOS network could radically affect market share and competitive relationships. It had never been self-evident how they would compete in an EFTPOS network. At first it was assumed that banks would compete within the agreed infrastructure of EFTPOS UK but this depended on all banks supporting EFTPOS UK. The breakdown of EFTPOS UK proceeded via the mistrust that was generated by the arguments over DES versus RSA, the compatibility of PDQ with the national system, the significance of Connect and the role of Barclays in EFTPOS UK once Connect had appeared.

## 5 EFTPOS leads to a new perception of the market

### 5.1 EFTPOS as a threat to share of retailer business

The merchant acquirer business involves the collection and clearing of the retailers' accumulated cheques, cash and EFTPOS transactions. Before the arrival of EFTPOS the retailer account was treated in a similar way to a personal customer account, although it was of course larger. A retailer might have an account with Access and Visa to clear credit card transactions and a third relationship with a clearing bank for cash and cheque clearing. As a paper-based system this was a fairly undynamic, stable market for the banks, since they all offered the retailer a similar service.

One of the key retailer requirements of EFTPOS was that there be only one terminal for processing all electronic transactions. The solution of the UDCS was that all members of EFTPOS UK would compete to acquire retailers by placing an EFTPOS UK terminal in a retailer. As long as the UDCS was indeed unified, the terminals could take all the banks' plastic cards and the retailer would have a complete clearing service with whichever bank had placed its terminals.

It was intended that when EFTPOS UK began to install the national system the banks would start offering electronic terminals to retailers at the same time. This would pose a threat to those banks, above all Barclays, that had the greater share of the paper transaction acquisition market, because many of their retailers might immediately be poached by other EFTPOS UK members. This was the way in which competition was intended to occur within the EFTPOS UK system - the equality of the banks in offering similar terminals with one standard of operation would represent the "level playing field" of EFTPOS UK and banks would compete to provide a different service through these technically standardised terminals. Barclays realised that they could secure a part of their larger retailer business by expanding PDQ in the years before EFTPOS UK was ready. When Barclays declared that Connect would not be entered into the UDCS it meant that EFTPOS UK terminals, whenever they appeared, would not be able to take Connect cards. If Connect built up a sufficiently large card base and terminal population quickly enough, it threatened to wholly or partly displace the UDCS.

Another reason why Barclays may have taken the step of issuing Connect was the way the UDCS changed the relationship between acquirer and issuer

banks to favour issuing banks. This effectively discriminated against Barclays, as the largest acquiring bank.

*It would give the card issuer control over floor limits<sup>8</sup> that the card issuer never had before... EFTPOS UK gave us a chance of setting these floor limits down to a much finer level.*

However, the other banks were faced with the difficult problem of how to respond to Connect. The larger English clearers chose to start their own proprietary debit card schemes. By issuing its Visa debit card Lloyds effectively took the Barclays path, of a Visa-linked debit card scheme. The Switch banks differed because their scheme was not linked to the Visa organisation and so was free to set up new rules to govern their card scheme and the operation of terminals. Both Lloyds and the Switch banks were seeking to guard against the threat of Connect, but by taking the different routes to a debit scheme, ie Visa and Switch, they were creating the commercial environment in which rival EFTPOS networks would grow.

The intensification of competition between the banks resulted in the loss of the collective benefits which EFTPOS UK was intended to provide, such as end-to-end security through transaction encryption and terminals which could take all card schemes. By offering retailers a choice between two developing card schemes - the Switch and Visa schemes, the banks would have to compete much more fiercely to gain retailer business. Failure could lead to the extinction of the card scheme and the supporting EFTPOS network. As a result, the retailers were put in a much stronger position to influence technical design than they had been when the EFTPOS UK network was the only one on offer.

## 5.2 Retailer attitudes to EFTPOS UK

There was bad feeling between retailers and banks over EFTPOS UK, with the retailers criticising aspects of EFTPOS UK's design and the banks denying their right to influence EFTPOS design. This bad feeling predated EFTPOS since the retailers had long resented the banks credit duopoly in the form of Access and Visa credit cards,

<sup>8</sup>A floor limit is the sum above which a purchase will be referred to the bank for authorisation and below which the terminal would accept the transaction.

*(retailers) sensed that EFTPOS UK was a way of taking that duopoly and growing it into, not just the 10% of business that people were doing on credit cards, but the 100% of business they'd do on debit cards or the replacements for cash and cheques.*

The retailers simply did not trust the banks when the banks claimed that the competition allowed for in EFTPOS UK would benefit retailers. They assumed that some kind of extended "duopoly" would be used to pass the expense of the technically sophisticated national scheme on to themselves. For example, the encryption of transaction data using the untried<sup>9</sup> RSA algorithm was seen as adding costs to national EFTPOS, while the banks saw it as a chance to reduce fraud significantly. In particular, there was the problem of the combination of the EFTPOS UK card scheme with its delivery system which the retailers,

*seized upon as evidence of the banks' nefarious or supposedly nefarious aims to leverage their power on to the retailers.*

If the card scheme and delivery system were bound together, it would be more difficult for retailers to use their buying power to encourage rival EFTPOS networks that would depend on cheap terminals and perhaps credit scored debit card schemes.

Before EFTPOS UK the banks had consulted with the retailers, but relations began to break down over the EFTPOS UK BIS,

*an increasingly difficult environment was created because with the Retail Consortium taking a very strong line about the Barclays' situation the banks inevitably closed ranks and said things like, 'We won't talk to these people because as soon as you talk to them you give them power and authority' and formal communication really broke down from that point onwards.*

The banks ceased to talk as a group to the retailers about EFTPOS UK. In spite of this, individual banks continued to meet retailers to discuss the bank's experimental EFTPOS systems. It was in this way that the banks learnt about retailer needs and they began to change their attitudes towards retailers,

<sup>9</sup>RSA has existed for as long as DES, but the EFTPOS UK national system would have been the largest ever use for the algorithm.

*as competition began to win out then concern about retailers was beginning to win through... they were becoming more concerned that the retailer wasn't going to play ball with EFTPOS UK and the Retail Consortium had taken up a position which was a very political position... which was a position which was now beginning, unlike their earlier position of '86/87, by '88 and early '89 was a position of 'we won't play at all. You don't understand us and you don't want to understand us.'*

Banks began to see that retailers would never work with the EFTPOS UK scheme, however desirable that scheme was from a banker's point of view - but they only gained this insight because they were developing competitive card schemes and working closely with the retailer. From a position where many retailers were simply treated as larger and more important versions of the personal client, the banks developed a detailed understanding of retailer needs,

*We spent ... two or three years learning very rapidly and now if you ask anybody in this department - what is your average retailer? From your lower end of the market right to your top 500 - what would you see their requirements as being? Then you'd find we have as good an understanding as the retailers and staff do.*

Retailer attitudes to EFTPOS UK were summed up by an EPOS manager in a large retailing chain,

*I think that we felt that the whole concept had been done by people sitting outside the shops thinking how it should be done rather than somebody looking from the shopkeeper's point of view and the customers point of view more or less the same point of view in this case.*

Once Connect had broken the UDCS and proprietary debit card schemes began to become competitive the banks could not afford to ignore retailer demands, whether or not they agreed with them,

*it became a matter of competitive advantage to be the one that had the connection to the retailer and if they couldn't do it on our standards because we weren't ready, they chose to do it in a way which would give them maximum use of their own existing investments in this very much off-line type system and at lowest possible cost, to undercut any competitor. and that in fact, is the story behind Switch.*

The increasingly competitive environment forced the banks to cheapen the design of their EFTPOS systems and to adapt to the spectrum of retailer variety. The retailers effectively gained the EFTPOS system they had argued for when objecting to EFTPOS UK.<sup>10</sup> One bank manager commented on EFTPOS UK,

*In 1986 when we got into a position to try to build something, it makes you wonder how we thought we knew what we wanted to build - when you think about it. How we thought we knew what was best for everybody, ourselves and retailers included - and we didn't.*

Another consequence of the focus of competition on the merchant acquirer market was Lloyds move to become "dual acquirers", ie they would process both Access and Visa transactions collected from one retailer. All the banks quickly followed Lloyds move to join both Visa and Access so that Lloyds initial advantage was rapidly removed - but for a short time retailers were switching to Lloyds to avoid the duplication of effort involved in relating to two separate banks, one for Visa and one for Access. Hawkins explained this move in a conference presentation.

*We've done our research and for many retailers, most retailers by number, EFTPOS isn't even a blip on the screen yet and those suppliers who have tried a force feed approach are paying the price of mounting losses on their terminal populations. In my view, the real issue for retailers in the plastic card market place is flexibility and choice and this applies just as much to technology as anything else. (Hawkins 1989)*

When Hawkins refers to a "force feed" approach it is almost certainly a reference to the perception that the Switch banks' deals with retailers have been aimed at building up the population of Switch terminals, rather than making money in the short term. They are suspected of losing money on the terminal functionality that has been installed in large retailer chains.

Once the major banks had all joined Access (or more correctly, Mastercard) and Visa, Switch was left as the one scheme which did not include all the banks. This meant Switch banks were effectively "triple acquirers" (Mastercard, Visa and Switch) and could offer retailers more than Lloyds

<sup>10</sup>Although retailers criticised the EFTPOS UK national scheme and were suspicious of the significance of the design of the BIS they were never able to argue coherently as a group for a different scheme.

and Barclays providing retailers valued having the Switch facility. However, because of the large number of retail outlets that currently take Visa paper transactions a Visa debit card should have more customer appeal and hence retailer appeal than Switch, so the Switch banks were in the position of having to make a large investment in establishing the viability of their scheme. This is especially the case as the Switch scheme only uses electronic transmission, (unlike the Visa debit card schemes), and so the Switch banks have had to build up a terminal population to compete with the many Visa paper-based outlets. One Switch banker commented that,

*it's a question of accepting at the moment that it isn't going to be as profitable as one would like in the short term... if you have the aspiration to be a long term player and if you are a clearing bank then money transmission is a core element in the service that you provide and we see it as a strategic game, a strategic goal to stay as a major player in the money transmission market, acquiring market.*

The Switch banks' decision to establish a rival card scheme and network resulted in fierce competition to place terminals in retailers and to take retailer custom from other banks. This has accelerated the rate of electronic terminal adoption by retailers and so brought the benefits (and potential problems) of EFTPOS to consumers earlier than EFTPOS UK could have done.

#### **6 New Forms of Competition Lead to Changes in Culture and Business Definition**

The change from collective support of EFTPOS UK to the adoption of competing card schemes as a means to achieve EFTPOS occurred gradually and involved much reworking of competitive positions. As part of this process some of the banking language was also reworked. The meaning of a "merchant acquirer" changed from being the processor for some of the retailers' paper transactions to the provider of a comprehensive range of clearing services, both paper and electronic.

The meaning of EFTPOS changed. Since the major reason behind EFTPOS had been reduction of banking costs it was originally seen as a product which if designed well and introduced carefully could solve many long standing problems in the banking industry. Hence Hawkins:

*Most other banks see EFTPOS as a product. This is a philosophy which is both outdated and outmoded and it has spawned single product market solutions - PDQ, UDCS and more latterly, Switch... all suffer from the implied arrogance of treating all retailers the same and consumers as cannon fodder. (Hawkins 1989)*

Other banks would disagree with Hawkins' analysis, but the language denotes increasing concern to serve the variety of retailer needs. With the rise in importance of the retailer, the banks see EFTPOS less as a product and more as another delivery system, like cash or cheques, which transmits money in a manner that suits retailer requirements. One manager described the period when his small bank reworked its EFTPOS strategy after Connect,

*...really we were trying to redefine for executives understanding what EFTPOS was... EFTPOS itself was no longer a product, if we'd ever thought of it as a product. It was fine, maybe, to provide it in the early 1980s as a product to a few retailers to experiment with, but it had grown from that. It was a delivery. It was just a way of taking money off the punter and handing it to another punter ... all we're doing is making it electronic money transmission. So it's a utility.*

This emphasis on the core business of the bank is another change from the pre-EFTPOS period. With money transmission defined as the core business without which the existence of the bank would be threatened, EFTPOS becomes an essential goal for survival and something that must be introduced quickly rather than planned for a distant future date. It becomes the core activity which a bank must protect while undermining the same activity in rival banks and, as the significance of EFTPOS for inter-bank competition was realised, its definition shifted from important product to vital utility. So the banks experience of attempting to implement EFTPOS led them to a changed understanding of what EFTPOS could do and of what it was. The changes in language described in this section reflect these changes.

#### **7 Competition from retailers use of EPOS**

The number of EPOS (electronic point of sale) terminals in retailer outlets exceeds the number of bank-installed, stand-alone EFTPOS terminals. This has implications for the banks' core business of money transmission in that part of the transmission of money is done by hardware

owned by the retailer. In the case of chains like Sainsburys or Boots, the terminals are linked to head office computer processor centres by a proprietary network. These head offices collect the day's transactions and write them onto a tape which is passed to the retailer's banker for clearing and so part of the process of "money transmission" is carried out by the retailer rather than the bank. The result is the retailer can claim a much higher proportion of the benefits that come from replacing paper with electronic transmission when it comes to negotiating over the acceptance of debit card schemes.

Bankers sometimes react to this view by arguing that cheque and paper processing is simply a cost: by implication it does not matter who removes this cost provided that it is removed. However, it does matter for the banks. They lose their ability to retain all the benefits of EFTPOS as they have to bargain to gain access to the retailer's terminals and must compete with rival card schemes in the process. Unless the banks are able to control the technology necessary for processing electronic transactions they would be better off retaining the old paper processing technology, which had the merit that *retailers could not erode their core business*. Fear of competition from retailers' use of EPOS has not been the most important factor influencing the breakdown of EFTPOS UK. Rather, banks became aware of the significance of EPOS developments as a consequence of the development of the competitive networks and their necessarily closer relationships with retailers.

#### 8 Change in competitive intensity influences technical choices in EFTPOS design

Previous sections have described how the banks moved to develop proprietary EFTPOS systems instead of supporting the EFTPOS UK system, the main reason being the need for speed of deployment in the fight to retain retailer market share. A range of technical choices were effectively forced on the banks by this commercial imperative, and by the need to meet retailer demands, whether or not these were perceived to be in the long term interest of the bank.

##### 8.1 Competitive pressure results in qualitative changes at the front end of the EFTPOS networks

In the case of both EFTPOS UK and PDQ, the banks assumed that some form of data encryption was necessary, but when retaining retailer business became a competitive goal the banks wanted the quickest and easiest method of placing a terminal or interfacing with retailer terminals. Interfacing with EPOS terminals when there were secret encryption keys at the point of sale required expensive physical protection for the encryption device and raised terminal costs. For this reason Switch dropped encryption at the point of sale,

*...it's a commercial perspective. ...If we had said to retailers you must use RSA or DES... it would not have got off the ground.*

PINs were lost with the loss of encryption and the Switch banks were forced to retain signature as a means of identification. Similar commercial reasoning led to the abandonment of an on-line functionality in Switch terminals, at least in the early period of Switch development<sup>11</sup>,

*So whether or not the member banks of Switch wanted an off-line system, it was the only one they could actually develop quickly enough to be in the market place cos they actually had it available.*

The feature of EFTPOS which has come to be most closely modelled on retailer needs is the terminal end of the network. This varied from a software modification in EPOS equipment to enable the reading of a new card scheme to the provision of a variety of on and off-line stand alone terminals designed to cater for the patterns of transactions a retailing business experienced. This includes the present development by PDQ of a hand held terminal suitable for taxis.

##### 8.2 A centralised or a decentralised processing service?

For a short time the EFTPOS UK BIS did represent a centralised model of how to process the banks' retailer transactions. EFTPOS UK could have been expanded into the joint processing centre for all the banks. However, as early as 1987 the banks balked at this idea and looked for a means of development which would allow them to retain closer links with their

<sup>11</sup>Later phases of the Switch scheme have been able to offer retailers on/off line terminals.

retailers. The solution was "devolution" which meant that the BIS might be a centralised pilot scheme but the national scheme would see the "devolution" of its acquiring function to the different banks' in-house processing centres. One problem was that retailers simply did not believe in this solution, their view being that if the banks truly intended to decentralise acquiring and compete for retailer custom, why were they running a centralised pilot scheme? As the banks came to know retailers better, they realised that the retailers would never work with the EFTPOS UK scheme and this further eroded the banks' commitment to EFTPOS UK.

### 8.3 EFTPOS UK Locked into Technology Development Trajectory by Organisational Factors

The EFTPOS UK organisation undertook reviews of its progress and development options and was aware that the "experiments" the banks were funding were becoming more important as alternative routes to EFTPOS. One option that was debated internally was whether to take a low-tech development route to bring forward the date when terminals could begin to be installed in the retailer. This was rejected because Switch was already doing that and it was inconceivable that EFTPOS UK would be allowed to exist if it pursued the same route as Switch. In a sense EFTPOS UK was "locked in" to the development of RSA and end to end security because these activities made it a distinct organisation and that is what it needed for the continuance of the pretence that it was developing the national system.

### 8.4 A Common Electronic Clearing?

There remains one issue in EFTPOS where the banks believe that there are still reasons to cooperate. The technology being developed by EFTPOS UK was abandoned in April 1990 and the BIS scrapped but the banks kept a group under APACS with the name of EFTPOS UK as a "forum" to discuss the possibility of a common electronic clearing. While the Visa and Switch networks are rivals at the front end of the EFTPOS network ie where they connect with the retailer, they have the common function of clearing transactions between the banks. One might think that there is an over-riding logic in a common clearing because at the moment there are three networks which link the banks to each other for clearing Switch, Visa and

Mastercard transactions. The banks are paying three times over to maintain three clearing networks where any one of the three could take the capacity of all EFTPOS transactions likely to be generated now and in the future. For example Midland Bank acquires Switch, Visa and Access transactions and so clears these via Switchnet, Visanet and the Mastercard clearing networks.

Some interviewees have argued that if the role of EFTPOS UK had been limited to providing a forum for discussions on a common clearing then the problem of three clearing networks would not have arisen. It was because the EFTPOS UK solution came to be seen as at once too ambitious, yet technically, and hence commercially, too constraining at the terminal end that banks began to develop their own networks.

Now that the banks have formed Switch and Visa blocs, a common clearing might be achieved by passing all transactions through one of the clearings developed for a proprietary network. However, political fears are more important than the argument from economic common sense; some members of Switch are not happy that other organisations should gain a say in how Switch does its clearing. The distrust generated between the banks by Connect is an important influence on this issue of a common clearing. Whatever form this took, whether that of a reconstituted EFTPOS UK or through the admittance of Barclays and Lloyds to Switch decision making,

*...we would be constrained in the way that we operate. We would bring it (Switch) into a forum where some of the parties are not exactly friendly to Switch... and they would have a say in how Switch would operate. Which is really going back to where the EFTPOS UK thing started and where it started going wrong.*

The problem in taking transactions from Visa or Banknet<sup>12</sup> is that these are commercial organisations who now have a vested interest in retaining the volume of transactions they have built up in their own networks. Another problem with merging Switchnet into Visa is that Visa is not directly controlled by the UK banks and this would be the first UK clearing to be controlled by the rules of a non-UK organisation. At present (1990), the banks have not been able to resolve these issues and have continued to

<sup>12</sup>Banknet is the Mastercard network

develop the three networks independently, while maintaining a forum to review the situation.

## 9 Conclusions - competition and cooperation in the structuring of a new technology

### 9.1 Summary - changing competition and EFTPOS

EFTPOS is a network technology that is poised not only to replace but also to transform qualitatively the banks' core business - money transmission. The development of an EFTPOS network was made possible by improving component quality and decreasing component price. There were many ways in which it could have been introduced but the initial collective approach, based on a longstanding tradition of cooperative working, broke down as the banks realised the implications for existing market shares of the retailer acquirer market. Competition grew more intense as banks behaved in ways which broke the informal rules of behaviour which had prevailed previously. The resulting mistrust led banks into a new pattern of sub-alliances to develop proprietary EFTPOS networks linked to competing card schemes. The competitive focus on rival card schemes led to closer relationships between individual banks and retailers, and hence evolving EFTPOS networks which reflected variation among retailer needs.

Although there were potential new entrants to the retailer acquirer business, in the form of the building societies, this was not the primary threat that prompted the increase in competition among the banks. More important was the perception that EFTPOS could change long standing market shares and so seriously affect the relative standing of old established banks. A secondary result of competition by card scheme is that the building societies and other new entrants have been effectively excluded from the control of the evolving networks, although they may affiliate for a fee. The erosion of the banks' control of money transmission by retailers' use of EPOS was also a factor of secondary importance in the decisions that shaped the present EFTPOS strategies. Banks became aware of the significance of EPOS developments as a consequence of the development of the competitive networks and their necessarily closer relationships with retailers.

### 9.2 Some possibilities for the future of competition and EFTPOS

At present, competition between the banks is being pursued through attempts to establish the dominance of rival EFTPOS networks - Visa and Switch. This is being done by building up the card populations affiliated to the rival card schemes and increasing the terminal population in retail outlets. Once retailer outlets are saturated with terminals from one or other of these networks, competition cannot continue in this form. In the case of the proprietary ATM networks, a commercial agreement to allow different card schemes access to different networks eventually emerged; the banks may come to a similar agreement between Switch and Visa. If the rate of change of the technology then decreased for a time, competition might weaken; if it did not, the banks might be caught in a spiral of intense competition where they must maintain a high level of investment, upgrading terminals and facilities in order to retain retailer merchant business. It is our view that the continuing opportunities for technical change will not allow a return to the weak competition characteristic of paper clearing, but that once the basic networks have been established competitive intensity will slacken. Progressive upgrading of terminals to on-line status, encryption at the point of sale and alternative authorisation technologies to signature are current possibilities; in the medium term smart card technology is likely to become viable and may represent a significant break with the existing EFTPOS technologies.

There will always be a case for collectively introducing future EFTPOS innovation, because an EFTPOS network provides a means of relating to your rivals as well as competing with them. The EFTPOS UK principles have been abandoned for a short term "market-led" EFTPOS solution, but the problems that encryption and on-line working were meant to solve remain, and the banks may well reintroduce these features in the future. Some managers believed that schemes like Switch would gradually work their way back to an EFTPOS UK approach because,

*all of us believe (in EFTPOS UK) that they're going to run into just as many if not more technical problems in following a much larger scale off-line type development... gradually they will come face to face with the same sort of issues and they'll reinvent the same sort of approach to handling a higher proportion of on-line transactions during the day.*

Bankers have repeatedly implied that the development of Switch is barely economic, but that they see no alternative. The strongest statement of this sort came from a manager of a bank which will join Switch, but after the start of the scheme,

*To be quite honest with you, we'll spend far more (in 6 months) going live in Switch than we ever spent in EFTPOS UK. And it's hurting, you know? We've got to do it. The Bank have again looked at this real close up and they're now, as I say, into detailed business cases where you've got internal rates of return which, I mean, look ghastly, and you can't get away with the sort of the blandishment about, y'know, we want to remain a clearing bank, though that's true!*

These comments on the high costs of Switch are another indication that the present intensity of competition cannot continue.

### 9.3 Competition and technology strategy: the case of EFTPOS

This paper has concentrated on the competitive aspects of the development of EFTPOS; the other themes to emerge from our grounded theory and which are listed in section 2 will be developed in other papers. Theoretical implications of the competitive aspects of EFTPOS development will be outlined here, but they will also be thoroughly explored in other papers.

There is of course a literature on competition and technical innovation. Porter, in his later work (Porter 1985) has upgraded technology to be a major source of competitive advantage and his emphasis is on how firms can deploy technologies to achieve desired competitive ends. He tends to emphasise how the firm is in control of outcomes such as industry structure and industry boundaries through its choice of relevant network technologies. One of the characteristics of the development of EFTPOS was the banks' evolving sense of what EFTPOS implied for their core business and the partial control they had over the development of the technology in a competitive environment.

The competitive significance of EFTPOS changed over the period investigated, and it is difficult to imagine how firms could have had a consistent or stable technology policy through which they maintained control over the process of implementation. The range of possible network technologies did not have entirely self-evident competitive implications

and it is hardly surprising that managers relied on their past experience of the banking industry when they conceived of the ideal EFTPOS network, or that they were shaken by the competitive reactions of other banks.

It is an interesting feature of the development of EFTPOS that it is not possible to present either commercial logic or the network technology as driving the development of the other; it is perhaps better to imagine that each network conception "maps" onto a different business conception. Throughout the development of EFTPOS the banks were learning how technical and commercial considerations could be related and were trying to establish and control the "end game" which would result from their competitive behaviour. In comparison with the period of relatively stable technology predating EFTPOS, the new technology can be considered to carry the uncertainty which renders the strategic decision making process so uncertain.<sup>13</sup> As part of this process the banks play strategic games based on an imprecise knowledge of the effects of their actions, a partial understanding of the implications of their technical choices and of the positions of other banks. The technology "generates" this uncertainty as there is no predetermined, optimal way of building the network and the commercial framework which links into it. The network is built as technical components are chosen which fit a bank's commercial position, but as it physically takes shape the technical components alter the commercial reasoning of other banks.

It should be possible to develop a series of "strategic maps" which show some of the possible routes to EFTPOS and the effects that different routes might have had on technical choices, industry structure and new entrants. It is interesting to explore how far such maps are equivalent to the creation of "strategic groups," whose existence has been studied in various industries (for example Harrigan, 1985) using techniques such as factor analysis.

<sup>13</sup>There is an obvious contrast between the turbulent inter bank relationships characteristic of eftpos development and the stable relationships before eftpos. The period before eftpos was characterised by a relatively static paper clearing technology which was well understood by the banks and which can be seen to have underlaid the banks' acceptance of stable market shares and weakly competitive relationships.

#### 9.4 Mapping of the Strategic Development of EFTPOS

The strategic map diagrams in figure 9.1 represent the principal strategic routes to eftpos and some of the possible effects alternative EFTPOS development would have on individual and total bank share of the merchant acquirer business. Market shares are represented by the area given to each bank within the larger area of the outer circle which represents the turnover of the merchant acquirer industry controlled by the banks.

In diagram A the industry boundary is labelled "paper" as the defining technology of the market and industry before EFTPOS. Retailers and third party processing bureaux are excluded from the industry and the control of any market share, while Barclays has the largest market share because of its early and successful moves to launch credit cards based on paper processed transactions.

Diagram B represents how the EFTPOS UK scheme might have evolved. The banks inhabit an industry defined by their joint control of the network. The outer circle retains roughly the same area as in diagram A because although EFTPOS has cheapened transaction costs it is assumed that the banks can retain the savings - as a group they do not lose a great share of the merchant acquirer business. A portion of the savings has been passed on to retailers to provide an incentive for the uptake of terminals, (hatched areas denote market share which has passed out of the control of financial institutions). Third party processors are excluded (off-line polling is presumed to be controlled by EFTPOS UK), but the new entrants to the financial industry all have the right to participate as retailer acquirers.

Diagram C represents the present situation where the banks compete to establish debit card schemes linked to either Visanet or Switchnet. Switchnet is being constructed from nothing, but Visanet is only installing the electronic front-end of its network. The Switch banks are therefore competing aggressively with Visa debit card schemes by offering cheap terminal upgrades to retailers and rapidly widening the membership of Switch, to allow Switchnet to gain economies of usage. The better deals offered to retailers by the Switch-Visa competition leads to retailers gaining a larger share of the benefits of EFTPOS than would have been the case in diagram A. The off-line nature of Switch forces banks

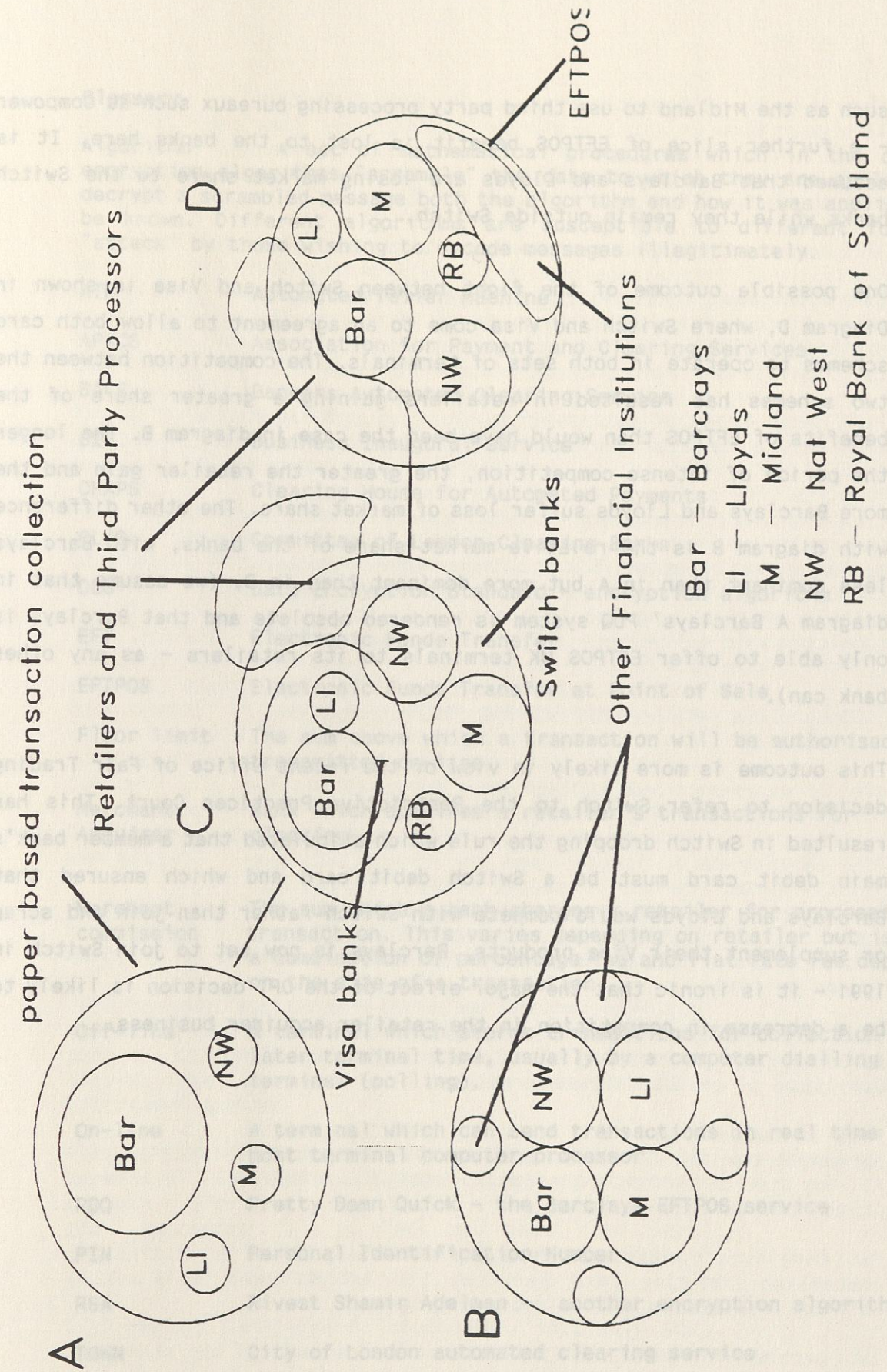


Figure 9.1 Strategic Maps for EFTPOS Development

such as the Midland to use third party processing bureaux such as Compower - a further slice of EFTPOS benefit is lost to the banks here. It is assumed that Barclays and Lloyds are losing market share to the Switch banks while they remain outside Switch.

One possible outcome of the fight between Switch and Visa is shown in Diagram D, where Switch and Visa come to an agreement to allow both card schemes to operate in both sets of terminals. The competition between the two schemes has resulted in retailers gaining a greater share of the benefits of EFTPOS than would have been the case in diagram B. The longer the period of intense competition, the greater the retailer gain and the more Barclays and Lloyds suffer loss of market share. The other difference with diagram B is the relative market share of the banks, with Barclays less dominant than in A but more dominant than in B, (we assume that in diagram A Barclays' PDQ system is rendered obsolete and that Barclays is only able to offer EFTPOS UK terminals to its retailers - as any other bank can).

This outcome is more likely in view of the recent Office of Fair Trading decision to refer Switch to the Restrictive Practices Court. This has resulted in Switch dropping the rule which stipulated that a member bank's main debit card must be a Switch debit card and which ensured that Barclays and Lloyds would compete with Switch rather than join and scrap or supplement their Visa products. Barclays is now set to join Switch in 1991 - it is ironic that the major effect of the OFT decision is likely to be a decrease in competition in the retailer acquirer business.

## Glossary

Algorithm	A set of mathematical procedures which in the case of encryption algorithms "scramble" the data to which they are applied. To decrypt a scrambled message both the algorithm and how it was applied must be known. Different algorithms are susceptible to different forms of "attack" by those wishing to decode messages illegitimately.
ATM	Automated Teller Machine
APACS	Association for Payment and Clearing Services
BACS	Bankers Automated Clearing Service
BIS	Business Inaugural Service
CHAPS	Clearing House for Automated Payments
CLCB	Committee of London Clearing Banks
DES	Data Encryption Standard - encryption algorithm
EFT	Electronic Funds Transfer
EFTPOS	Electronic Funds Transfer at Point of Sale
Floor limit	The sum above which a transaction will be authorised or transmitted on-line
Merchant Acquirer	Bank which acquires a retailer's transactions for clearing
Merchant commission	The sum which a bank charges a retailer for processing a transaction. This varies depending on retailer but is often a combination of percentage fee and flat rate fee depending on the size of a transaction.
Off-line	A terminal which stores transactions for collection at a later terminal time, usually by a computer dialling the terminal (polling).
On-line	A terminal which can send transactions in real time to a host terminal computer processor
PDQ	Pretty Damn Quick - the Barclays EFTPOS service
PIN	Personal Identification Number
RSA	Rivest Shamir Adelman - another encryption algorithm
TOWN	City of London automated clearing service

## Brief History of EFTPOS Events

1966 Barclaycard is the first credit card to be introduced in the UK, Worthington (1988)

1972 Access introduced into the UK, Worthington (1988)

1974 Committee of the London Clearing Banks (CLCB) hold joint discussions with view to establishing single, nationwide EFTPOS network. A full time working party is to devise and propose system specifications.

1979 Racal Transcom set up expressly to bid for and manufacture the developing national system's terminals

1980 The CLCB project team submits its report to the clearing banks. The system it proposed was considered to provide an expensive and commercially restrictive system and was rejected. Top level negotiations between the CLCB and the Retail Consortium on an alternative quickly collapse and the CLCB sets up a POS review committee with 4/5 members to decide advance the bank's EFTPOS thinking.

1980 Barclays sets up COUNTERSPEED, filling stations, Norwich area

1981 Barclays sets up SUPERCASH, on-line retailer link for verification of customer cards

1981 Barclay card, Access, Amex and Diners set up a jointly owned non-profit making company called On-line Credit Services to market the Racal TCL 100 authorisation terminal to stem growing credit card fraud. 10 000 of these "PDQ precursors" will have been issued by 1989.

1982 CLCB sets up a POS Terminal project team to define a strategy for introducing EFTPOS and an EFTPOS Policy Committee to control future progress.

1982 Clydesdale and BP launch COUNTERPLUS, first permanent on-line EFTPOS network in UK. Now over 55 filling station terminals throughout Scotland, Northern Co-op now has trial terminals.

1983 Barclaycard, Access American Express Diners Club - establish "On-line Card Services Ltd to set up Cardlink, telephone authorisation system.

1983 Barclays introduce PINPOINT, card activated vending service, machines set up in BR stations, 50 filling stations.

1983 BT and Cresta Communications set up TELETRAN, to market terminals in retail outlets...(now defunct).

1984 Nat West sets up PISCES, (Petroleum Industry Service for Clearance Electronically of Sales), Off-line, polled terminal network, polling in BT's midnight window.

1984 CLCB conducts "fundamental review" cost benefit analysis of EFTPOS possibilities and concludes that EFTPOS will not be an easy option. Costs of £1 per transaction are foreseen at which some banks are horrified. However, banks are also worried by the development of EFTPOS by Cresta Communications in conjunction with BT, which includes data capture and is popular with retailers. Banks agree to look at EFTPOS again and to encourage a "fast start" for credit card companies based on existing technology.

1984 Oct/Nov CLCB contracted Research Services Ltd to survey consumer response in Aberdeen to the Clydesdale/BP Counterplus experiment. 96% of consumers reported to be "happy" with card.

1985 January, Clearing banks and Retail Consortium announce their commitment to a national on-line EFTPOS network, looking to 1988 as inaugural year. "EFTPOS Development" is the organisation set up under APACS control which will conduct feasibility studies. Banks withdraw from joint cost benefit analysis leaving Retail Consortium to publish its report alone in 1988. During 1985 CLCB cosponsor 3 limited EFTPOS trials, SPEEDLINE, STREAMLINE and PDQ. EFTPOS Holdings Ltd set up with own budget.

1985 October Anglia Building Society and ICL establish PAYPOINT, 200 terminals in 120 retailers. Over 40 000 cards in circulation, on-line, PIN based.

1986 February, Midland Bank SPEEDLINE launched in Milton Keynes, 30 on-line terminals, PINs used for debit card payment. 6p/transfer. Accounts debited following day, service free to customers in credit, others pay ATM withdrawal charge

1986 STREAMLINE Development of PISCES by Nat West, 24 terminals installed, filling stations and retail outlets. Off-line with hot card file stored. Also £50 "memorandum" file to check that debit card users are within daily limit, (£50). Accounts debited 2-3 days after transaction.

1986 March, Barclaycard launch PDQ, initially 300 terminals and Barclaycard Visa accepted only, refund retailers 7p/transaction through savings on paperwork, midnight window polling handled by Compower.

1986 Barclays threaten withdrawal from EFTPOS UK on two issues. EFTPOS UK system must be compatible with PDQ and be DES based.

1986 October, Barclays announce that Connect will be launched in June 1987. (Worthington 1988)

1986 Autumn The number of small EFTPOS schemes that have started before the national approach has been agreed leads to concern amongst some of the banks and in autumn 1986 a task force is appointed to review the overall position. As a result of its report APACs (which replaces the CLCB) announces that agreement has been reached on a strategy for a national EFTPOS scheme. This will be an ATM type scheme which will be PIN based and on-line. The national scheme organisation is now called EFTPOS Developments Ltd, which will work with BT to fund the development of ETAN, an improved communications system compared to Cardway (which is based on PSS).

1986 Access set up ACCEPT, Romford

1986/87 "Standard 40", non-APACS approved industrial standard for EFTPOS terminals, DES based, agreed by various manufacturers.

1987 M&S acquire licensed deposit taker status from Bank of England, (Worthington 1988 p69).

1987 February "EFTPOS Administration Ltd" which had been formed within the APACs organisation, assumes responsibility as the governing body of the EFTPOS development. Its aims are to establish and coordinate the overall framework for national EFTPOS. The Chairman, Richard Allen and the General Manager, Brian Allison take up their posts.

1987 April At the CBI Conference the Chairman reveals a new corporate name - EFTPOS UK Ltd and the EFTPOS UK logo.

1987 May, Barclays launch CONNECT, as a VISA debit card, 3 days before deduction from customer account

1987 May EFTPOS UK announces the choice of RSA as an encryption algorithm.

1987 Barclaycard take over Nationwide Anglia's PAYPOINT

1987 Lloyds launch CARDPOINT in Peterborough

1987 July, IST-30 convened by BSI to form UK EFTPOS standards. Little progress made as there is disagreement about how to go about forming a standard, ie APACS and EFTPOS UK want standard based on "ideal"

EFTPOS system, other members want standard based on systems on the ground.

1987 July EFTPOS UK release their Business Service Specification for public consultation - this marked the end of the consultative stage of the national scheme.

1987 December, Barclays and the retailer associations reach agreement that Connect card charge will be a flat rate of 17.5 pence per transaction instead of the 2% of a transaction's value that Barclays had attempted to impose at the start of negotiations. However, for non-departmental stores the charge will relate to average transaction and turnover. (Worthington 1988 p62).

1988 April, Remaining UDCS members accept that UDCS should be called the "EFTPOS UK Card Scheme."

1988 May, EFTPOS UK considers funding development of an integrated EPOS/EFTPOS system, but does not go ahead.

1988 June, Lloyds, ACCESS member, now joins VISA and issues VISA debit card.

1988 June New rules on clearing announced which allow top 9 building societies to join BACS and the top three to join EFTPOS UK.

1988 October, Nat West, Midland, RBS launch Switch debit card scheme, members of scheme compete for card holders and to acquire retailers. Switch entered into EFTPOS UK Card Scheme.

1988 November Matrix and Link, the building society ATM organisations plan to merge (by April 1989) to prepare for some form of cooperative EFTPOS scheme.

1988 By end of year ICL estimates that 180 000 epos terminals have been installed in the UK and that by the end of 1990 a total of 250 000 will have been reached. This represents 60% of the potential market for epos.

1989 February, EFTPOS UK sales campaign for the BIS is due to start.

1989 March, Lloyds launch CARDNET, also becomes first dual acquirer for VISA and ACCESS. Single procedure for both VISA and ACCESS transactions, bank competition now is for acquisition of retailers. JCCC dissolved, marketing and sales functions go to respective banks while processing centre is sold off.

1989 May MMC report on credit card markets published.

1989 Barclaycard joins Mastercard and becomes dual acquirer

1989 Midland, Nat West and RBS join VISA

1989 July, Nat West first bank to offer unified Switch, Access and VISA service to retailers. Midland follows a few months later.

1989 August, Bank of Scotland and Clydesdale join Switch.

1989 Barclays and Lloyds apply to join Switch on an acquisition basis only. This would also allow them to offer triple service, VISA ACCESS and Switch

1989 September, EFTPOS UK BIS goes live, only one month later than planned.

1989 October, Switch banks complete reissuing of their major debit cards with the Switch logo.

1989 November, Visa electron card reintroduced with E symbol; to be an EFTPOS and ATM only card.

1989 November, Switch begins bulk data transfer between members, (BDT), replacing the physical transfer of tapes.

1989 November, Sainsburys one of first retailers to accept CONNECT, ACCEPT and SWITCH debit cards. 10% of Sainsburys turnover is already through Switch. By accepting these Visa debit cards but not the Visa credit cards Sainsburys has been allowed to break the Visa "Honour all Cards" rule.

1990 January, Switch turnover has reached £100m/month with 25 000 terminals in retailer outlets.

1990 June, Switch upgraded be able to process on/off-line terminals.

1989 EFTPOS UK applies to join another non-APACS standards committee, the "standard 50" group. This is formed by a collection of manufacturers and banks who want an industrial standard for polled EFTPOS systems ie off-line systems. Suggests a radical change in EFTPOS UK thinking.

Notes: There is a gap of several years between the experimental ACCEPT, COUNTERPLUS schemes and Switch...because the banks who experimented were holding back for the sake of the EFTPOS UK scheme, until Barclays attempts more than an experimental scheme with PDQ. By linking this to VISA Barclays attempt to impose it on all retailers that take VISA and establish their debit card scheme ahead of other banks.

It is the Connect scheme which galvanises Midland, Nat West and RBS to start Switch, initially based on the Midland's Speedline experiment.

The entry of Building Societies into competition with the banks has affected EFTPOS development. It will be difficult to charge the customer anything for the use of the debit card, as Midland did with Speedline.

IST-30 is the BSI committee which is attempting to form a UK standard for EFTPOS in general, and to provide an input into ISO and EC standards for EFTPOS. The Europeans have reacted "frostily" to the idea that an RSA based standard might emerge in the UK, and in fact IST-30 has begun to work towards a compromise standard which would allow for DES or RSA as encryption standard in EFTPOS systems.

The interviewees quoted in this paper were from the following organisations:

EFTPOS UK  
Bank of Scotland  
Bank of England  
Boots  
TSB  
National Westminster Bank  
Clydesdale Bank  
Yorkshire Bank  
Midland Bank  
Switch Card Services

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The Programme on Information and Communication Technologies (PICT) is a major initiative of the Economic and Social Research Council, which aims to explore social science perspectives on the rapidly evolving Information and Communication Technologies (ICTs) and inform policy debate in the field. The research is conducted by a network of six centres - Brunel University (CRICT); Polytechnic of Central London (CCIS); The University of Edinburgh (RCSS); UMIST (CROMTEC); University of Newcastle (CURDS); and University of Sussex (SPRU) - and coordinated from the University of Oxford.

Edinburgh PICT research is based at the Research Centre for Social Sciences and draws on expertise in the Departments of Business Studies, Economics and Sociology, as well as the Science Studies Unit. The group starts from the assumption that the development and implementation of new technologies cannot be wholly explained by technical considerations, but that complex social, political and economic factors are involved. The research effort therefore focuses on the 'social shaping' of ICTs, at the level of detailed technical design. It aims to elucidate the considerable scope which exists - for both producers and users of technology - to influence the direction and consequence of technological change. Much of the research involves building strong links with the policy community, in industry and in government.

Edinburgh PICT is part of a strong and growing base of socio-economic research on technology at the University, and runs a Doctoral Programme of Social and Economic Research on Technology within the Faculty of Social Sciences. Both teaching and research activities benefit from close links with departments in the School of Information Technology. In addition, members of the Edinburgh group collaborate with researchers in neighbouring Higher Education Institutions, and with other centres in the PICT national network.