# Is the future of the ATM past?

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*Abstract*

Just over 40 years ago the first cash dispensers became operational in the UK. From its modest beginnings this industry specific application evolved into the backbone of self service technology. In this article we consider their past and present to reflect on their future with the assistance of the so called 'social construction of technology' and 'path dependence' theories while supported by archival research and interviews with 'actors' in the UK. We tell how machine, functionality and shared networks will continue to interact in shaping the future of the cash dispensing market.

*Introduction*

Greater use of credit and debit card payments as well as the mirage of the 'cashless society', led some North American and British observers to consider automated teller machines (ATMs) a 'passing technology'.[2] Not so (or at least not in the foreseeable future) is the unanimous conclusion of 20 British managers in financial and non-financial intermediaries with direct responsibilities in self service technology (and management of ATM fleets), who were asked to opine on that sentiment between March and June 2008. Although the use of cash has decreased to 'historical' low levels, its use remains steady while the ATM remains the undisputed vehicle for people to acquire cash (as opposed to transactions at the bank retail branch or 'cash back' at food retailers).

But why look at ATMs in Britain? What makes the UK cash dispensing market interesting? After all for almost half a decade, ATMs have not gone far beyond 'cash and dash' in most countries. Besides, there might be more interesting examples like Portugal and Spain where ATMs offer a wider range of services and functionality than in Britain. We deemed the UK market interesting because the first successful cash dispensers were deployed in England in 1967. Access to surviving records in business archives, patent filings as well as interviews with engineers and bankers, allowed us look at the development of this technology from its inception through to its diffusion and 'maturity'. All of these stages within the same market. Through archival research we learned how Britain has often been a prime mover in ATM technology both in terms of experimenting with new functionality while, from a hardware perspective, NCR grew to dominate its manufacturing and R&D from the plant at Dundee, Scotland. Although the British self-service market has been innovative and highly successful in many respects, it has also experienced inertia and ossification in others.

Another aspect that makes the British market interesting is the creation of a single, jointly owned platform for interoperability of proprietary ATM fleets, namely LINK. A single shared national network stands out when compared to a peak of some 200 different national networks in the USA in 1986. Since achieving full interoperability in 1998, LINK grew to be the world's most active network dealing with up to 226 million transactions per month and at its busiest, processing over 1 million transactions an hour in 2007.[3] LINK has around 50 members and there are over 130 million LINK cards in circulation from around 38 issuers. See Table 1. A related feature to LINK is the fact that in the UK network few customers pay directly to have access to their cash balances through ATMs. This feature dominates the interaction between participants and being fairly unusual in the international

scene further distinguished the workings of cash dispensers in the UK. Given the longstanding involvement and unique features of ATMs in Britain, it seemed appropriate to ask for the thoughts concerning the current and future challenges of this technology. In this article, therefore, we report a summary of field work which used historical records to inform a survey of some 20 key contributors working in financial and non-financial organisations and active in the British cash dispensing market.

**[Insert Table 1 around here]**

As portrayed in Table 1, there are various business models (i.e. strategies) living together within the jointly owned platform. Many providers have developed systems for detailed profit and loss analysis of individual locations. These were introduced to give transparency to investments in maintaining and running their infrastructure to manage cash in-branch and non-branch locations. However, lack of agreement on which appropriation method to use results in a wide variety in cost accounting approaches and opens up the possibility of some systems looking more efficient than what they really are.

There is also variety on how the ATM is integrated with the retail branch. Since the 1970s some participants have given individual branches 'ownership' of the machine at their branch. Branch staff is then expected to replenish, provide some basic maintenance as well as being alert to faults and malfunctions. Others run the ATM fleet as a stand alone business. The result of having a distinct profit centre has often been to keep only the most profitable (or 'essential') branch locations.

However, in-branch is only 'unprofitable' if the location is considered on a stand-alone interchange basis. On a distribution strategy basis, the in-branch ATM is generally a lower cost way of serving customer requirements than over the counter. Therefore, it represents an efficiency gain. Relocation and closure of individual in-branch ATM locations are thus more likely to respond to strategic than to financial considerations.

Some medium sized or small asset sized intermediaries offer current accounts but own a handful or no cash dispensers at all. Having customers accessing 'free withdrawal' cash points owned by others implies paying the multilateral interchange fee (MIF) through LINK.[4] The value MIF reflects the average cost of acquiring members making their machines available to the card issuer. The MIF emerges from the combination of transaction volume plus actions to make LINK more cost effective, secure and reliable.

Most financial intermediaries compete for non-branch locations with independent ATM deployers (IAD). Since their emergence in 1998, their business model has been to install machines at non-branch locations to offer greater 'convenience' (e.g. pubs, corner shops and small or medium sized train stations), in remote or otherwise unattractive places. The IAD model is driven by a lowest cost operator mentality, allowing them to plug the geographic and opportunity gaps in distribution. Some IAD generates income through MIF in high 'foot traffic' locations. In others, machines usually levy a surcharge.[5] The typical IAD prefers to work with 'easy to use' hardware and some of them actually sell the machine to their landlord (in order to focus on operational issues). As a result, some IAD models find viable locations with as little as a half a dozen transactions per day. Transaction volume is much lower than dispensers at branches of financial intermediaries and food retailers: IADs now control half

the number of machines in operation but are responsible for about four percent of total annual transactions.

Interestingly, some financial intermediaries have responded by locating 'free withdrawal' machines nearby those of IADs and even successfully deployed surcharging machines. An example of the latter has been Alliance & Leicester, which has deployed surcharging machines under its own brand name while escaping vilification by the popular press.[6] On balance, IADs are not considered serious competitive threats to established financial intermediaries. Especially as IADs have failed to develop their own independent relationship with frequent users. However, competition for non-branch locations has sparked a rise in rental fees that has significantly impacted on everyone's margins. IADs and financial intermediaries now question the financial viability of many locations while increased competition has lead to a drop in the number of independent IADs.

Peter Welch and Steve Worthington have reflected on the threats of food retailers to banks in the UK.[7] Their work identifies distinctive actions in the process of product diversification to offer finance or financial 'products', a move that has also been called 'financialisation'.[8] However, joint ventures between banks and retailers (namely Tesco and the Royal Bank of Scotland Group in Tesco Personal Finance; and J. Sainsbury's and HBOS in Sainsbury's Bank) as well as unique models (the collaboration of the Co-operative Bank with stores owned by its parent, the Co-operative Group) brought about shared ownership of ATM locations with the highest 'foot traffic'. To little surprise these three shared locations are the largest net acquirers within LINK and have effectively neutralised the competitive threat of retailers (as far as the cash dispensing services market is concerned).[9] As stated by one interviewee:

> '[Food retailers] will not be a source of anxiety as long as they continue to sell financial services as if they were baked beans.'

The success of food retailers has been to change the mentality and perception of customers about when, where and how some financial services can be acquired. It is exactly the 'baked bean' mentality that enables the supermarket to act as channel for a mass market of financial 'commodity products' like unsecured loans, general insurance and cash distribution. If this should change, the more astute financial intermediaries have positioned themselves to make sure that they have a part in future developments of financial products by non-financial players.

So with a single national shared network and major competitive threats having been either co-opted or thwarted, is there any realistic expectation for 'new and improved' cash dispensing technology in the UK? As detailed in the next two sections, there are incentives and disincentives for the future of business models in the cash dispensing services market as well as the technology supporting ATMs.

*Path Dependence*

A *path-dependent* sequence of economic change is one in which eventual outcomes are influenced by remote events, including developments shaped by circumstances rather than systematic planning.[10] When faced with alternative technologies, random developments can give advantage to one which becomes the norm as it is further adopted and further improved. This implies that an early lead

combined with chance events may eventually 'corner the market' as other technologies are 'locked-out'.[11]

That approach would see the ATM embedded in the long term process of automation and mechanisation, that is, the 'robotisation' of both the internal processes of financial intermediaries and of individual transactions in retail financial markets. This technological trajectory spanned the 20th century and saw the introduction of type writers, steel filing cabinets, telephones, punch card tabulators, mechanical and electro-mechanical accounting machines. After De La Rue committed to supply its cash dispensers exclusively to Barclays in 1967, Chubb's MD2 was basically the only available technology and consequently became the leading cash dispenser in the UK during the 1970s.[12] The likes of IBM, NCR, Burroughs and Diebold then had to adapt and comply with the four digit personal identification number (PIN), dimensions for external facia, and many other decisions made by Chubb in the UK, Omron-Tateishi in Japan and Docutel in the US, rather than by designing from first principles. At the same time, alternative technologies to 'brick and mortar' distribution such as drive-in, mobile branches and postal deposits were either completely abandoned or sidelined.

But automation of banking did not happen for its own sake but because intermediaries sought to achieve greater efficiency (specifically of cheque clearing, cash distribution and of the accounting function). Automation and computer technology also facilitated the diversification of financial and non-financial intermediaries within retail financial markets. This process took place in tandem with large pools of individuals becoming active in these markets; after having been marginalized or excluded throughout the contemporary history of Western style capitalism. This trend accelerated in the UK with the digitalisation of customer accounts on the back of the decimalisation of sterling in 1971 and the payment of wages directly into current accounts (replacing payment by cash). In the late 1970s and early 1980s, cash dispensers were seen as a critical device for competition in retail finance, as a way to ease congestion at retail branches (especially by banks) as well as a way to be a credible competitor in the High Street (by building societies).

More recently, the success of cash dispensing technology in moving customers out of the retail bank branch has been superseded with a view that considers the effective deployment of self service technology in branch to create a clean and welcoming high service environment, where staff are on hand to assist with transactions, but more importantly, to advise and sell. This move has been supported with the introduction (in the UK and elsewhere) of automated cash counting machines. The new devices sit along side or bundled with cash dispensing technology and have overcome customer resistance to envelop deposits (a feature of cash machines since the 1970s but which never really found customer acceptance). The new cash depositing facilities offers on-line, real time crediting of customer accounts, voice recognition of the amount deposited as well as photographic evidence of cheque deposits.[13]

But in the success lies a paradox: more automation is desirable as it can help to reduce cost structures; but operational considerations have inbred a new challenge as to how to engage the customer (who is no longer coming into the branch) in a sales pitch. Opportunities for advertising are limited but could be made more effective. Time and again market reports tell of consumer distaste for general advertising at the cash terminal and printing information on the back of receipts has had little

success to raise awareness (as well as being environmentally unfriendly). Solutions suggested by manufacturers, such as NCR's tailored software screen behind 'My @TM', have been largely unsuccessful.[14] Meanwhile, pitching for regular non-customers is attractive as in their every day life consumers tend to use the same three to five locations on a regular basis. Net acquires of transactions could be tempted to develop targeted advertising for users banking at other financial intermediaries. But retrieving the information to make this possible could be contrary to the British data protection legislation.

Could greater automation in the form of ATMs be used to attract new customers? Today's customers expect the transaction at the ATM to last no more than 30 seconds (i.e. 'cash and dash'). This has resulted in a reduced functionality of the ATM in 2008 when compared with that offered in the dawn of the technology: already in 1975, IBM and NCR promised British customers the possibility to carry out not only withdrawal of bank notes but also make deposits, deal with account enquiries, place chequebook or account statement requests, obtain foreign currency exchange rates and make account transfers.[15] In 1984 the NCR 5070 was considered the first full function machine while offering transfers, payments, printing of detailed statements and envelope deposits.[16] Today most 'through the wall' machines are limited to cash dispensing of different denominations, balance enquiry and at some machines, mobile phone top up.

One has to acknowledge that since the 1980s the cash dispenser has been mechanically reliable. After forty years of successful operation and increasing technical sophistication, there is a direct link in the evolution of cash dispensers into ATMs and from the latter to platforms for self service technology in airports and food retailers. Yet participants in our survey were unanimous that automatic cash dispensing was, is and will be the *raison d'être* of the ATM. This to explain why through their history alternative banking related functions have been tried and tested while manufacturers always have had innovations in the pipeline which never found broad acceptance.

Some participants opined that any innovation in the foreseeable future is more likely to emerge associated with software and in a way that can be shared through the network. On the one hand, there is limited action (and indeed incentives) for individual organisations to depart from the established norm to the extent that innovations within proprietary networks fail to achieve 'critical scale'. On the other hand, the challenge for any proposed innovations around the LINK platform (such as Oyster card in London) is to make a business case that is acceptable to all members.

Legacy information technology platforms partially explain the inertia and reluctance for widespread adoption of innovative software-related applications. Some platforms can take up to ten years between updates and these come at non-trivial costs.

Finally, it is worth mentioning the success story of Wincor. By 2002 the Paderborn-based German company was very much on the way of mounting a successful challenge to the leadership (and for some, complacency and arrogance) of NCR as the leading global hardware and software provider of ATMs.[17] Today, managers of middle-sized and even some large participants in cash dispensing find Wincor hardware and software a solution they are happy to embrace wholeheartedly. Many feel Wincor 'has listened to the customer'. Some of its software has indeed become the norm. Other

providers, however, prefer not to outsource their software as they see the development of technology platforms a core capability.

*Path Construction/Creation*

Path dependence has been mainly used by neoclassical economist to explain exceptional cases where 'history matters'; under the general assumption that history does not matter. For economists, path dependence relates to sub-optimal solutions, to things that ought not to have happened. However there is increasing evidence from the historical record that has shed a different light on market errors and lock-in to technological trajectories.[18] The ATM fleet is part of a wider network of electronic payment systems and as such it influences and is influenced by developments around the penetration of credit cards, replacement of cheques and cash payment by debit cards as well as technology related to electronic terminals at point of sale (EFPOS). These are increasingly global networks and thus, developments in large 'virgin' markets such as India and China could well influence the workings in Europe and North America.

The idea of the ATM configuration being a sub-optimal solution and emerging from fortuitous circumstances or chance developments is also debatable. Cash dispensers did not materialise from the ether nor from someone's inspiration in a bath tub. There is a strong case to be made for users (such as Barlcays Bank and Midland Bank) shaping the nature and functionality of the original technology. Later on, in the early 1980s, some of the success of NCR conquering the position of world's manufacturer was due to close attention to ultimate consumers in the development of an easy to use interface (as opposed to seeing ATMs as remote terminals of a mainframe or working solely to attend banks' concerns with security and interoperability). As for things to come, it is possible to think (although unlikely in the foreseeable future) that a further drop in cash transactions will bring about the decline or indeed the elimination of ATM technology. This would open the possibility for the dominance of cash distribution through alternative means like payback at the point of sale.

There are thus reasons to believe in the 'mutual shaping' or 'co-evolution' of technology and society.[19] From this perspective the stability of technology is fragile. Social change, for one, can introduce alternative 'needs'.

An example of alternative 'needs' relates to vulnerable consumers.[20] For instance, strict guidelines to assure accessibility of cash points to the physically disabled in the UK. In spite of costly adjustments to layouts and screens to increase usage, many 'vulnerable customers' still avoid ATMs for fear of being exposed to assaults whilst conducting cash transactions in the open. They prefer to use telephone banking, internet banking or tellers at retail branches. How to engage with vulnerable consumers is very much in today's and tomorrow's agenda for the providers of cash dispensing services. Particularly as government population forecasts suggest that the group of people aged over 75 years (that is, another group of potentially vulnerable customers) will grow by 76 per cent in the next 25 years.

Interaction with the larger public should thus be seen as a source of potential innovation, organisational learning and necessary adjustments to changing policies. Other notable situation in the history of ATMs in Britain, along the lines of social change, relates to 'phantom withdrawals', that is,

debit transactions that the customer disputed. Few of today's managers of ATM fleets remember having dealt with a 'phantom withdrawal' but between 1981 and 1993 problems associated with them dominated public attention as mirrored in tabloid newspapers (i.e. Daily Mail) and annual reports of both the Banking and the Building Societies' Ombudsmen. The Jack Committee estimated that there was on average one disputed ATM transaction per hour across the country. Whilst it was not known how many breaches of ATM security involved a dispute at all, since only small sums were involved, it seemed reasonable to assume that there was a widespread dissatisfaction.[21]

Phantom withdrawals are part of a larger debate about the security and integrity of the cash withdrawal system and have to be understood in the context of whether customer or card issuer would take responsibility for the consequences of fraud. Banks had traditionally assumed the consequences of fraud when cashing a cheque with a false signature. But when confronted with the possibility of phantom withdrawals, financial providers claimed that the transaction had to be correct because the withdrawal had been activated by card and PIN. Financial intermediaries rejected the possibility of technical failure while downplaying the risk of fraud (or trying to pass its consequences to retail customers). This was important from the standpoint of the service provider in order to maintain confidence and overall consumer trust in electronic payment systems. However, some 'ill feeling' permeated the previously unspoiled record of the ATM, since clients felt their honesty and integrity was being challenged. Specifically since it turned out that fraud and to a lesser extent technical and clerical error had indeed taken place. Integrating mini-cameras within the ATMs helped to sort out fraud from 'abuse' (namely, a family member other than the account holder using the card and PIN versus a stranger having effectively cloned the card and PIN).

In our view, the morale of the story was that the episode gave LINK the incentive to find a quick solution to the Parliamentary enquiry of 2005 into cash machine charges.[22] Under the leadership of John Hardy, LINK responded pro-actively and instead of letting public sentiment about financial exclusion soar, LINK was expedient in producing a survey of low income areas that identified locations where no 'free withdrawal' machines were available. Results suggested 83 per cent of the 10,000 lowest income areas had access to free of charge cash machines but deploying 700 machines would raise the coverage to 90 per cent. In order to reach that target, individual members were to be compensated for deploying machines in otherwise unprofitable sites through the payment of a 'financial inclusion premium' (one well above the usual MIF for any transaction made at free withdrawal machines). By April 2008 more than 400 free to use cash machines had been installed. [23]

LINK's social action is unique to the UK amongst the world's ATM deployers. For its supporters, the move evidences the organisational learning that helps to explain why 'first movers' are better able to cope with technological and social change.[24] For sceptics, it is a move that aims to pre-empt regulatory action. But regardless of which side you support, there is evidence that members of LINK were persuaded to act in unison while LINK's staff have since then been ready to explore alternative services, new locations and innovative functionality for its members to address changes in social circumstances. Innovations which could disrupt an otherwise stable 'technological trajectory'.

*Conclusion*

Whether it is within the corner shop, the hole in the wall of the food store or the automatic kiosk in an man-less retail branch; in the next five to fifteen years the ATM technology is here to stay … but how? It is unrealistic to think that their evolution will be solely dominated by inertia or by disruption. There is clearly an interaction between the future of the machine, its functionality and the potential for shared networks. Ultimately, technological trajectories are neither accidental nor predetermined but responsive to their users. This being the supplier of cash dispensing services or the ultimate consumer. As one interviewee opined:

> 'Convenience is the driving force behind ATMs and I have yet to see something, [ultimate] consumers want, disappearing.'

However, when interacting with technology retail customers no longer constitute a homogenous group. Our research suggests that the young consider automation (in the form of cash dispensing equipment) a fact of life and are confident to interact with it in their daily lives. Young people expect more convenience, meaning the availability of cash dispensers at leisure facilities. They are also willing to experiment with new functionalities like mobile phone top-ups. In tandem, there is a growing proportion of elderly people making active use of self serving technology. Indeed, cash dispensers have sat in the High Street for most of the adult life of today's 65-year olds. But this group is less willing to experiment with new applications. Another aspect to be considered is that vulnerable consumers such as pensioners and the physically disabled have special requirements for 'safe environments'. They generally do not object to self-service, but they want it to take place while they are in control of who is approaching, in well lit spaces, with help readily available.

Other sources for innovation relate to changes in business models, ATM hardware and software. These can be solutions that combine greater convenience for customers and cost effectiveness for financial intermediaries. Some of these are already on the horizon. Most notably automatic counting technology, which can be expected to be more widespread as it will help reduce transactions at the retail bank branch teller as well as articulate the idea that branch staff should focus on selling rather than dealing with low-value-added transactions.

Security concerns have permeated the history of this technology and will most likely continue to do so. The recurrent themes being vandalism of fascias, protecting the store of money and ascertaining that the person has the right to debit the account. But a balance must be found between the cost of upgrading the stock, financial economies of increased security and the impact that such technology might have on customer convenience. For instance, one could expect software applications developing on-screen alternatives that replace the ten button keyboard to feed a PIN.[25] At the same time, security upgrades such as iris and finger print recognition will remain 'moth balled' until the cost of fraud versus cost of deployment effectiveness increases and, more important, customers are ready to accept intrusive applications such as iris, finger print and biometrics in chips.

As has often been the case in the history of the ATM, increased cost effectiveness takes place either by developments elsewhere (that make such technology more affordable) or increase fraud. Since the latter has been pretty stable for the last five years, it is more likely that other applications making use of iris and finger print recognition (say in airports) make this sort of technology a better

proposition for ultimate consumers and in turn, provide incentives for users to upgrade their stock. Yet there is greater potential for the interface with ultimate consumers to change by replacing the plastic card inserted into the card reader. This through contactless, mobile phone (mCommerce) and new 'form factors' applications providing highly convenient recognition, validation and authorisation solutions.

Cash transactions via ATMs still lack a purposely designed statutory framework in the UK. The banking code of conduct has settled some of the most burning questions concerning liability. But overall the new risk profile that has emerged from electronic payments and their provision by non-bank payment providers has not been tackled head on by the Law nor by regulatory authorities. Identity theft, operational breakdown and malicious attacks have taken unprecedented forms. In response to these, self-regulation of the industry has lead to real-time controls over payment authentication and improved payment processing. However the possibility of public involvement in risk management is looming at the horizon. For example, by aligning responsibility and control in matters of data protection and operational security.[26]

In financial markets one must always keep an eye on the future actions of regulators, competition and monetary authorities. For instance, the impact of developments around the Single Euro Payments Area (SEPA) over current business models. SEPA rules already clearly define how a transaction should be treated a cross borders. In this respect the biggest barrier relates to IADs. Specifically only as to whether surcharging will be allowed, and if not, what will be the sustainable level of interchange fees in a pan-European market. At the same time, global banks could side-step developments around SEPA by developing an advantage through the creation of an internal platform for international payment clearing that offers customers lower charges than those of clearing through VISA, Mastercard or a possible pan-European network. However, the costs of developing such interconnection must be balanced with the low percentage of retail clients which are indeed internationally mobile.

But perhaps the most important future innovation will be the use of ATMs to articulate customer relationship management initiatives. As mentioned, from its beginning as stand alone cash dispensers to modern ATMs, this technology has been very successful in helping to move customers away from the retail bank branch. This view has evolved as ATMs are now seen as key in the deployment of self-service initiatives. The apparent success of pilot projects involving automated cash deposits will further acerbate that trend and reduce foot traffic. How then will financial intermediaries engage customers in a sales pitch? Clearly, the aim being to discuss offerings with consumers the intermediaries are interested in pushing out the door rather than to pitch for 'commoditised' products (that can be sought and ascertained by customers through the post, internet or telephone). The ever-crucial 30 seconds customers are willing to spent in front of an ATM screen could be filled with targeted adverts, information or features while cash is being dispensed, provided these other activities are lawful, fast, intuitive and easy to understand as well as simple to operate. A challenge that one would like to think is likelier to be met by the ingenuity of managers at financial intermediaries than of directors of food retailers or engineers at Dundee and Paderborn.

**Table 1: Business Models in the UK Market for Cash Dispensing Services (Number of machines in operation with reference to location - 2007)**

| Types of Operators | Number of operators | Branch ATMs | Non-Branch Free ATMs | Non Branch Pay to Use ATMs | Sum | % |
|---|---|---|---|---|---|---|
| **Bank** | 11 | 10.811 | 8.684 | - | 19.495 | *30%* |
| **Building societies turned bank** | 5 | 4.047 | 1.636 | 952 | 6.635 | *10%* |
| **Mutuals (Co-op Bank & building societies)** | 7 | 1.491 | 3.53 | - | 5.021 | *8%* |
| **Independent ATM Deployers** | 13 | 2.589 | 4.05 | 25.184 | 31.823 | *50%* |
| **Retailers* and others** | 3 | 13 | 11 | 926 | 950 | *1%* |
| **Sum** | 39** | 18.951 | 17.911 | 27.062 | 63.924 | |
| **Percent of total** | | *30%* | *28%* | *42%* | | *100%* |

* - excludes Tesco Personal Finance ** 11 of LINK's 50 members do not own any ATM

*Source*: LINK statistic on member's ATM networks, December 2007

*Endnotes*

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[2] For the UK see for instance Coopey, R., 2004, "A Passing Technology: The Automated Teller Machine", in Lyth, P. and H. Trischler, eds., Wiring Prometheus: Globalisation, History and Technology, Aarhus University Press, Aarhus; Harrington, A., 1997, "The Future lies in On-Line Banking", CA Magazine, 101 (1088), Institute of Chartered Accountants of Scotland, Edinburgh pp 4 and 16-20. For the USA see for example Haber, L., 1996, "Banking on the future", LAN– New York then San Francisco, 11 (7), 119-123.

[3] http://www.link.co.uk/mn_homepage.html (accessed 25.05.2008).

[4] Note the MIF is not paid to LINK but by the issuer to the acquirer. LINK only acts as clearing house and facilitates the movement of the fees. Moreover, it is set differently for branch and off-premise locations and also differently for cash withdrawals and balance enquiries. It is designed to reflect the average fully burdened cost of serving the transaction. As such, it rewards the efficient (with profit) and punishes the inefficient (with losses). This should theoretically result in a downward pressure on interchange fees. However, regulatory and compliance costs often distort the picture, with mandated upgrades significantly impacting the cost base from time to time.

[5] Under LINK rules, owners of machines providing 'free' withdrawals receive the MIF. 'Surcharging' machines will not receive MIF as the customer is paying for the service directly. Surcharges could be seen as a payment by ultimate consumers for convenience whilst 'disloyalty charges' seen as a levy to discourage own customers using machines from others.

[6] In October 1998, as part of its incorporation to LINK, Barclays attempted to introduce a £1.50 'disloyalty charge' (Sunday Times, 1998, "Big four banks join the Link", 25.10.1998.) The 'disloyalty charge' was to be paid to the customer's bank while the acquirer received the MIF. As late as November 2005, the *Daily Mail's* Sean Poulter continued to report over the 'cash machine rip off' (Daily Mail, 2005, "Why more of us have to pay to draw out our cash", 12.11.2005).

[7] Welch, P. and S. Worthington, 2007, "Banking at the check out", Journal of Financial Transformation. 21, 77-84.

[8] Froud, J. et al..Financialization and Strategy. Routledge, London (2006).

[9] All retailed locations are publicly tendered each year. Locations of other large food retailers are primarily served by HSBC on either rental space (Asda and Morrison) or outsourcing agreement contracts (Marks & Spencer).

[10] David, P., 1985, "Clio and the economics of QWERTY", American Economic Review 74 (2), 332-337.

[11] Arthur, B. W., 1989, "Competing technologies, increasing returns, and lock-in by historical events", The Economic Journal 99 (394), 116-131.

[12] See further Bátiz-Lazo, B., "Emergence and evolution of proprietary ATM networks in the UK, 1967-2005", Business History (forthcoming).

[13] It is interesting to note that Luther Simjian's Bankograph first introduced the idea of photographic evidence of deposits in 1959. See further Bátiz-Lazo, B and R. Reid, "Who invented the ATM", Association of Business Historians Annual Conference, Birmingham (2008). Also New York Times, 1961, "Machine accepts bank deposits", 12.04.1961.

[14] Spotlight, 2000, "Personalised ATM", 09.2000, 9.

[15] Financial Times, 27.05.1975.

[16] Kotter, J. P. A Force for Change. The Free Press, London (1990), 27.

[17] Spotlight, 2002, "Danny's talk", 07/08.2002, 6.

[18] Liebowitz, S. J. and S. E. Margolis, 1990, "The fable of the keys", Journal of Law and Economics 33 (1), 1-25; Liebowitz, S. J. and S. E. Margolis, 1995, "Path dependence, lock-in, and History", Journal of Law, Economics & Organization 11 (1), 205-226.

[19] Pinch, T., 2001, "Why you go to a music store to buy a synthesizer", Garoud, R. and P. Karnoe, eds., Path Dependence and Creation, Lawrence Erlbaum, Mahwa N.J.

[20] Vulnerable consumers are said to encompass young people, older people, members of some ethnic minorities, unemployed, in low income, suffering from long-term illness, or suffering from a disability. See Ritters, K., Consumer Education in the UK. Trading Standards Institute, London (2003), p. 5.

[21] Banking Services: Law and Practice Report by the Review Committee, Chairman: Prof. R.B. Jack, Her Majesty's Stationary Office, London 1989, p. 79 and 83.

[22] Increased pubic discomfort with the growing number of IADs resulted in a Parliamentary enquiry into payment of cash machine charges .Interestingly it was an enquiry with a focus on into cash machine charges by IADs and their effect on consumers as a whole. See House of Commons, Treasury Committee, Fifth Report of Session 2004-05, Cash Machine Charges, House of Commons Paper No. 191, 2005. Regarding the popular feeling at the time, see Daily Mail, 2004, "MPs probe cash machine charges", 21.12.2004.

[23] LINK press centre, 2008, "Link reports continued progress in installing free-to-use cash machines in lower income areas", online at: http://www.link.co.uk/press/2008/mn_press_release_20080410.html (accessed 02.06.2008).

[24] Chandler, A., 1992, "Organizational capabilities and the economic history of the industrial enterprise", Journal of Economic Perspectives 6 (3), 79-100.

[25] Blair, S., 2007, "Grid expectations", Engineering & Technology 2 (12), 28-29.

[26] Sullivan, R., 2007, "Risk Management and nonbank participation in the U.S. retail payments system", (KC Federal Reserve Bank) Economic Review 2nd quarter, 5-40.