A Historical Appraisal of Information Technology in Commercial Banking

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INTRODUCTION

Table 1 summarizes two dimensions of technological progress in retail banking. These dimensions describe the nature of change brought about by technological innovation on bank organizations’ external (product or service) activities and internally on their operational functions. Although other dimensions might offer a more comprehensive treatment of innovation in financial services, the dimensions portrayed suffice to provide a historical perspective on the adoption of technological innovation in commercial bank markets.

As being determined by a combination of changes in banks’ external environments and advances in information technology, Pugh (1973: 28) was one of the first contributions to document widespread empirical support on the effect of technological innovations on bank organizations in adopting technological change. According to this view, managers are passive over the breadth of choices that will modify the effectiveness of skills, procedures, capabilities and other internal resources. This suggests that, on balance, managers respond to external change by adjusting the boundaries around which their organization is drawn. Hence, the rate at which new ways of doing things can be internalized is contingent on the organization’s circumstances. However, empirical studies do recognize that, despite the limitations imposed by the context in which organizations perform, managers have plenty of leeway in making their influence felt in the pursuit of competitive advantage (Pugh 1973). In other words, the research considers that bank managers have little influence over the development of technological innovation while, simultaneously, the actions (or omissions) of managers in banking organizations in adopting technology are considered critical in determining how technological innovations modify competition in bank markets.
In what follows, the discussion of technological innovations that altered the provision of financial services will cover external changes over methods of undertaking transactions (between customers and bank) and changes up to the point at which customers’ service activity enters the banking system. The discussion will also cover technology-induced changes in internal procedures. In particular, changes over operational functions and process innovations are explored. These changes and innovations will be identified, first, as changes in national payment systems, that is, changes in distribution of cash and coins between the central bank and individuals rather than bank assets as substitutes of cash balances. Second, changes in the delivery of deposit lending and settlement transactions. Third, changes in the storage and retrieval of accounting information.

The research, therefore, offers a summary of major IT-based innovations and an analytical framework with which to structure a historical review of how IT innovations were adopted in bank markets. This historical review defines participants in bank markets along the lines of Klein (1971: 206), Baltensperger (1980: 1), Swank (1996: 193) and Radecki (1998: 4). Following these contributions the basis for financial intermediaries (rather than open markets) supplying financial products and services is considered to be the existence of transaction and information costs. As a result, the research identified commercial banks as organizations with the capabilities, resources and competencies for retail financial mediation. In other words, organizations able to accept deposits without explicit payment of interest (sight accounts) and which create assets that are generally acceptable means of exchange (paper and electronic payment instruments). The discussion thus emphasizes how the performance of organizations dealing in low-volume but high margin (i.e. retail) transactions changed through the applications of new information and telecommunications technologies and resulted in product and operational (process) improvements. Where appropriate, however, the discussion will also offer examples in corporate and investment banking.

Alongside the general review of the absorption of IT innovations by banking organizations, particular attention will be given to IT innovation in United Kingdom (UK) bank markets in general. The UK, and England in particular, is used as the benchmark because the UK hosts the world’s largest international banking centre and also has a large and highly competitive wholesale banking market. As a result, the UK tends to lead and has preceded other developed countries in the introduction of changes regulating financial markets (Bank of England 1991). UK participants in bank markets also seem to have adopted many key technology innovations before counterparts in North America (Bátiz-Lazo 1998: 277). Focusing on UK bank markets also provides an opportunity to explore whether technological change enhanced the importance of computer systems within the strategic compass of commercial banks and provides some insight as to whether IT-related change has increased the potential for transparency in bank markets.

We proceed as follows. The next section considers the effects of outstanding IT-based technical innovations as grouped into four distinct periods defined as covering early adoptions (1864–1945), specific application (1945–65), emergence (1965–80) and diffusion (1980–95). The section also considers the potential impact of more recent innovations in payment systems, the so called ‘electronic purses’ and Internet banking as well as their likely effects on competition within bank markets. The final section discusses the implications of IT-based change for the corporate strategy of commercial banks.
INFORMATION TECHNOLOGY INNOVATION AND BANKING

Early adoption period1 (1864–1945)

Although particularly important news could be transmitted by special procedures such as mirrors, beacons or, in the case of the Battle of Waterloo, by carrier pigeons, more formal improvements came from the introduction of telecommunications into bank markets. This occurred in 1846 when the telegraph reduced stock price differentials between New York and geographically dispersed regional stock markets (Garbade and Silber 1978: 823). The 1866 introduction of the trans-Atlantic cable enabled greater integration of securities trading in New York and London (ibid.: 827). Greater integration took place as the completion of the cable reduced the time delay in executing a trade in New York that had been initiated in London. The completion of the cable effectively reduced the time to complete a transaction originating in the UK for execution in the US from six weeks to only one day. According to Garbade and Silber (1978), early innovations such as the introduction of the trans-Atlantic cable were accompanied by statistically significant evidence that the introduction of even limited forms of telecommunication substantially reduced or even eliminated foreign exchange and security price differentials between geographically distinct markets.

However, evidence has yet to develop to support the possibility that market integration increased or continued during the years that followed each new communication innovation, as well as to support the degree to which integration continues to emerge after each adoption. Evidence in Garbade and Silber (1978) suggests that the adoption of new forms of communication accounted for (proportionally) smaller reductions in price differentials. Their evidence suggests that the adoption of telegraph or telephone communications primarily produced the same kind of effect, with subsequent adoptions leaving information asymmetry among market participants relatively unchanged. However, greater use of telegraph or telephone facilities also resulted in both internal and public price-related information becoming homogeneous. Banks could link head office with branches in different locations, allowing more centralization and the balancing of supply and demand of loanable funds across their network rather than at each area centre. They could also ensure the uniform and rapid dissemination of public price information to security dealers and bank branches. Unsurprisingly, statistical evidence of enhanced market integration was strongest for early developments, because these targeted the pricing anomalies and serious information delays that characterized the transmission of financial information prior to the introduction of telecommunication applications (ibid.: 831).

The early introduction of telecommunications into bank markets did little to modify front-office procedures – the way in which transactions between customers and bank were conducted. For instance, the amalgamation process that swept UK banking after the introduction of limited liability banking during the late nineteenth century resulted in financial intermediaries with nation-wide retail branch networks. However, it was not until the 1950s that UK commercial banks actively pursued the aim of becoming depository institutions for excess funds or began to develop non-deposit products for mid-income customers (more below).

During the early adoption period, bank customers entered the banking system directly through retail bank branches or indirectly through agency representatives (such as savings banks, mortgage specialists and even retail outlets). Telephone exchanges between bank managers and customers were used as early as the 1890s but, in spite of this, service remained largely unaffected by technology with the front-office relationship controlled locally through asynchronous, analogue systems such as paper-based records and pass-book control.

At the time, financial intermediaries practised little in the way of systematic product and customer group diversification. Head office accounting control was based on the aggregate outcome from decentralized discretionary authorities for all but the most important relationships. The main function of the centre was to manage cheque clearing and relations with the central bank and to engage in treasury operations. Head office was also in charge of policing performance through financial control and draconian inspection methods. Long-term relations of individual customers with the bank retail branch were needed to secure services such as loans or establish credit ratings and as a result, managers of retail bank branches were persons of independent authority and standing in their local communities. Meanwhile, individual banks performed international transactions such as clearing bills of exchange through networks of correspondent banks abroad rather than through open markets.

At the end of the 1930s the first tabulating machines were purchased to address the growing volume of transactions and enhance working conditions and productivity of senior staff (Wardley 2000: 83–9). This trend was reinforced by the purchase of additional adding and listing machines that supported the growing network of branches and agents. However, the potential of these machines, as well as punch-hole ‘accounting’ machines, as mechanisms for recording and updating transactions were not fully exploited until after the late 1940s and early 1950s. Increasing the size of the branch network and divesting under-performing agents then became a priority. Performance indicators primarily measured growth in size (such as assets per employee and investment referrals) rather than efficiency or effectiveness (such as financial profitability and credit risk exposure). Moreover, during this period, financial performance of the branch network and individual retail branches was examined only at random and when specifically commissioned by the Board or the Finance Committee. Customer service was more likely to be determined by personal relationships than objective facts. This...
was reflected in the appointment of large customers to bank area or regional boards.

The characteristic provision of financial services in retail markets was to change with the commercial use of computer power. According to Locke (1999: 5) and Leslie (2000: 49), the most important IT applications had their origins in US government-sponsored research in the first half of the twentieth century. Interactive IT applications would never have existed without a long and expensive gestation period in which computer power and telecommunication applications were devoted to help the US gain the initiative in science and technology. Indeed, the UK experience with computer hardware development would tend to confirm Leslie and Locke’s view of a defence-based technology push behind the development of highly sophisticated hardware and software as well as the networks that linked computers together. For instance, the first stored-program computer in the world was developed in 1948 by academics at Manchester University (Anonymous 1998). However, the reduction of local autonomy in the cluster of technology companies, such as Ferranti and ICL who sponsored the research, reduced the funding available to Freddie Williams and Tom Kilburn and they were thus unable to continue with their project.

In brief, early adopters of telecommunications and computer applications had greatest impact in organised high value wholesale bank markets, that is, those activities that had traditionally been furthest away from high volume, low value retail bank branch transactions. Banks began to absorb the new lower-cost technology on the back of a growing market for retail bank services, which expanded as middle-income individuals became a growing proportion of the population. However, it was government-sponsored research in the US rather than bank initiatives that provided the driving force behind the original innovations that would result in interactive IT applications during the 1970s.

Specific application period (1945–1965)

The second wave of IT innovation in retail finance began in the late 1950s and lasted up to the late 1960s. Banks introduced computers both to keep up with growth in business volume and, at the same time, to solve some very specific problems in bank operations. They also took the opportunity to automate existing standing practice in specific departments (e.g., BBC 1995, Morris 1986, Seeger et al. 1974). The introduction of computer power relied on US-based suppliers of accounting machines such as IBM, Xerox and Burroughs (later Univac and Unisys). Initially, computer manufacturers responded quickly to the demand for hardware but failed to make much concession to users’ software requirements (Fincham et al. 1994: 153), or to recognize the new strategic possibilities reduced information costs provided. The lack of ready-made software products forced user organizations to devise their own solutions to this problem until the emergence of high-level programming languages emerged from joint collaboration of users and computer manufacturers (ibid.).

At the time, banks aimed to develop the capacity to handle more complex and higher level service tasks with their existing ‘high street’ skills and resources. This resulted in the branch network quickly turning into the main point of contact with retail customers while, internally, there was a growing need to supply top management with prompt (i.e. quarterly) financial information. A process-directed automation thrust dominated the specific application period and aimed at undercutting the cost of administrative tasks such as the labour-intensive cheque clearing system. During this period, the typical financial sector computer installation consisted of a central mainframe (ibid.: 154), dedicated to sequential batch processing of computer readable instructions dealing with separate processes such as providing a service for handling customer transactions, standing orders and other clerical procedures. Computer applications were therefore concentrated on back-office operations (Morris 1986: 77), because controlling a growing mountain of paperwork provided the potential for economies of scale. There was also an incentive to automate at the individual branch bank level and to improve market-wide processes.

By 1965, most major banks in the US and UK had been introduced to electronic data processing and many of them had seen the arrival of their first computer installation. Towards the end of the decade, with the introduction of a second or third computer, a major redistribution of organizational responsibilities followed. Organizational change tried to solve the apparent paradox between greater efficiency associated with automation (i.e. greater centralization) and enhanced service offerings to customers associated with devolution of discretion to customer-facing staff at retail branches (i.e. greater decentralization). Greater automation and improved communications such as automatic internal switchboards resulted in the establishment of central accounting units and in centralization of customer account control so that retail bank managers as well as regional managers lost autonomy to centralized senior managers. Centralization on the back of computer applications, therefore, created a space for a standardization of service offering and the potential to reduce cost structures of traditional activities.

The increasing complexity and volume of financial transactions eventually led to the development of Database Management Systems or DBMS (Fincham et al. 1994: 154). The role of the DBMS was to overcome the limitations of conventional filing systems by providing a generalized, structured and integrated body of data that could be read and updated in a controlled, efficient, and reliable way (ibid.). Two key applications built on DBMS and took place in 1968. First came an inter-bank voucherless payment facility called the Bankers’ Automated Clearing System or BACS (Morris 1986). The second innovation involved the installation of the National...
Girobank, the automation of retail national and international money transfer through forms handled by Post Office outlets (Thomson 1968).

In 1968 major UK banks established their first computer-based intra-organizational network while aiming to exploit the cost advantages of electronic data interchange or EDI (see further Báriz-Lazo and Wood 2001). This network emerged in the form of an electronic transfer system of payments (called BACS) to which non-clearing banks could subscribe, but only through a clearing member acting as agent. The BACS system grew to be the world’s largest automated clearing house, with a total staff of approximately 200 handling 262 million items by 1976 (Cooper 1984: 53). The development of BACS created an inter-bank facility in an attempt to bring under control rising costs associated with the huge growth of cheque transactions during a period of fast economic growth and the postwar recovery of consumer markets (Gardener and Molyneux 1990: 84). Enabled by regulation in 1972, BACS also aimed to create new sources of bank business by moving wage payment away from cash and into bank accounts. As a result, the use of standing orders, direct debits and payroll credits became widely available in the UK. In countries such as France, Germany and the US pre-authorized transactions were not as widely established and most electronic clearing was limited to Government payroll credits (Price Commission 1978: 34).

Another important innovation in the UK money transmission system during the specific application period was the establishment of the National Giro Centre (later Girobank) in 1968. Girobank was the first full computer-centred financial intermediary (Thomson 1968: ix). Its original purpose was to help update the Post Office by making it the distribution channel for low cost transactions (Girobank 1993). Internationally, the UK was a latecomer to this service. Austria pioneered postal giro in 1883 and (Girobank 1993). Internationally, the UK was a latecomer to this service. Austria pioneered postal giro in 1883. The UK was a latecomer to this service.

Nonetheless, the UK’s Giro Bank was a sign of things to come with regards to:

- Its specialization in terms of activity (money transfer) and market segment (low-income banking and benefit payment);
- Its creation of an alternative retail money transfer system utilizing an existing non-dedicated distribution channel already in place (Post Office counters);
- The competitive challenge it offered through focused operations that lowered costs to process payment orders and bank cheques (12 and 20%, respectively).

Succinctly, during the specific application period, computer-based applications emerged and operated in isolated departments of the banking firm. During this period the first IT applications in bank-client transactions were introduced. Enhanced computer power allowed banks to concentrate the processing of the growing volume of paper-based transactions in central locations where labour costs could be reduced through dedicated staff and automation. This would suggest that greater use of IT applications in banking reinforced the hierarchical and volume driven ethos of financial intermediaries serving retail markets while promising product diversification on the back of standardized service offerings and reduced cost structures. At the same time, computer power enabled managers of banks to look for more standardized (and cheaper) labour while a new set of IT-related capabilities began to emerge as a necessary condition for competition in bank markets.

**Emergence period (1965–80)**

The third wave of IT innovations in retail finance emerged hand-in-hand with advances in telecommunications. During the emergence period, banks became one of the world’s dominant customers for computer-based applications, far exceeding other sectors such as capital goods manufacturers or transportation (Quintás 1991; Scherer 1982). Between 1968 and 1980 banks emerged as major customers of software and hardware as they introduced applications that delivered significant cost reductions as well as increased business volume and variety. The main difference between this and the specific application period was that the impact of computers was felt throughout the organization rather than in specific departments. The ability to achieve higher quality and lower cost in an unprecedented way established large scale-economies in banking which were not offset by organizational discontinuities (see Walker 1978).

Developments in hardware and software that found their applications in the private sector in general and in banking in particular, were further enhanced with the reduction of government expenditure that had supported the space exploration project. As a result, throughout the 1970s many highly qualified individuals formerly working at NASA moved to the IT arm of the major consultancies and into investment banks and the treasury operations of US-based commercial banks. Changes were also observed in the recruitment strategies of banks outside North America. In the UK, banks and non-bank financial intermediaries began to recruit high-potential university graduates and prepare them for future positions as senior staff. This was a departure from the traditional practice of ‘internal job markets’ that developed in the 1920s (see Wardley 2000: 81–3). This practice involved the recruitment and in-house training of low-skilled and risk adverse individuals, who had few ambitions beyond the security of job ‘for life’ employment offered by banks and would require little motivation (Parker 1981: 147).

Early adoption of EDI in the UK as well as the change in recruiting practices were critical in securing the pre-eminence of London-based banks throughout the growth of euro-currency and euro-bond markets. In the Euro-market, banks accept deposits and issue loans denominated
in currencies other than that of their country of origin. Through Euromarket transactions participants minimize their exposure to sovereign risk and, in the process, segregate that exposure from currency risk. During the emergence period IT applications helped to achieve greater use of the Euromarkets by actively reducing the cost of placements, reducing the distance between syndicates, issuers, lenders and the secondary market; as well as through improvements in banks’ trading rooms and back-offices. IT-led innovation was thus critical to re-incorporate transactions in other financial centres (more below).

Other distinctive characteristics for banking organizations during the emergence period included the introduction of full automation to branch accounting, real time operation and control of branches by the central office. In the UK, Clydesdale Bank was the first to network every teller and cashier position, ensuring that every transaction had direct access to the bank’s online transaction-processing services (Fincham et al. 1994: 154–5). Concisely, the immediate result of innovations during this period was that customers were able to bank at any point in the retail branch network while the previous arrangement limited transactions to the customer’s own branch or required telephone approval for remote transactions. Indeed, the regional manager for a major UK provider reported at the time that: ‘the [bank’s] computer will provide to all branches an “on-line” enquiry service. Account balances and redemption figures will be immediately available ensuring a much speedier service to members and professional contacts.’

Panel A in Table 2 illustrates the growth of one of the most successful applications that emerged during the emergence period. It took place in 1967 when Barclays Bank (UK) introduced the first Automated Teller Machine (ATM) in the world (Barclays 1982), while IBM introduced the magnetic stripe plastic cards in 1969 (Báñez-Lazo et al. 2001: 867). Together these innovations marked the birth of electronic banking.

Barclays introduced credit cards to the UK by importing systems (including computer applications) from Bank of America (US) at the end of 1965 (ibid.: 865). Barclay’s early adoption of ATMs was no coincidence because cash withdrawal through ATMs is a major use for credit cards. Indeed, the emergence of the ATM marked the beginning of self-service banking as services previously provided by the bank teller could be performed on a 24-hour schedule and at the customers’ convenience rather than during banking hours. As shown in Panel B in Table 2, ATMs expanded rapidly in the UK and elsewhere as other institutions followed Barclays’ lead.

Noticeable changes in bank internal organization started to take place alongside the growth of a complementary distribution channel in the form of ATM networks. Banks realized that universal provision of ATMs involved a large scale investment in marginal or loss-making infrastructure and a heavy drain on financial resources and IT skills. Banks then increasingly sought critical mass through strategic alliances.

For example, the Co-operative Bank was notoriously slow to introduce ‘online’ systems. Only in 1987 was the bank able to offer online banking rather than the pass-book system through its agencies in Co-operative stores. To solve the IT problem, the Co-operative Bank pursued several collaborative solutions. One was to become a founding member of the LINK Group in 1984. The bank had 50 ATMs in its 78 branches but, through LINK, bank customers could access around 400 ATMs. This number grew and by 1995, LINK allowed access to over 8,500 ATMs in the UK alone, with the Co-operative Bank contributing 119 ATMs (managed by IBM under a £13 million outsourcing contract signed in 1994). Hence, 30 years after the introduction of the first ATM, the absurdity of terminals connected to different networks located side by side and long after terminal density had reached saturation point, eventually resulted in a single interconnected network in 1999 for the UK.

During the emergence period, the introduction of management information systems or MIS also took place (Fincham et al. 1994: 155). These systems initially aimed to use the computational power of transaction-processing capabilities to provide regular reports and analyses of business activity. In this way MIS offered increased scope for monitoring control and planning of operational procedures. Although MIS increased line management productivity, MIS systems proliferated throughout the organization but without any fundamental change in the nature of managers’ activities (idem).

In summary, during the emergence period technological change spread to many internal aspects of banking organizations and permeated bank–client relationships. These changes started to modify how, when and where customers could enter the banking system but banks had yet to reflect their new potential as multi-delivery channel organizations in their service offering and in their ability to direct all their information to any point of customer contact. It is during this period that the convergence of telecommunications and computer power resulted in true IT applications as the emphasis of technological innovations shifted from data processing to communications. At the same time, cost effective supply of financial services rather than customer value creation continued to predominate the design of banks’ internal organization and strategy development.

Diffusion period (1980–95)

The diffusion period of the information revolution in commercial banking saw the spread of IT to all aspects of banks’ internal organization and market relationships thanks to the introduction of personal computers (PCs) in clerical and managerial roles. During this period, consumer-oriented innovations were widespread as information technology finally provided support to all
Table 2. Growth of ATMs in the UK and elsewhere, 1974–95

Panel A. Bank branches and ATMs in the UK, 1974–94

<table>
<thead>
<tr>
<th>Year</th>
<th>Branches</th>
<th>ATMs</th>
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<tbody>
<tr>
<td>1974</td>
<td>14,908</td>
<td>N/A</td>
</tr>
<tr>
<td>1984</td>
<td>14,058</td>
<td>6,106</td>
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<tr>
<td>1989</td>
<td>13,131</td>
<td>12,253</td>
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<tr>
<td>1994</td>
<td>10,724</td>
<td>15,180</td>
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</table>

Source: Collett and Maher (1997)

Panel B. Cash dispensers and ATMs in four OECD countries, 1988–95

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<tr>
<td><strong>Number of machines per million inhabitants:</strong></td>
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<tr>
<td>Belgium</td>
<td>85</td>
<td>92</td>
<td>94</td>
<td>105</td>
<td>109</td>
<td>119</td>
<td>313</td>
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<tr>
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<td>284</td>
<td>305</td>
<td>325</td>
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<td>275</td>
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<td>314</td>
<td>324</td>
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<td>306</td>
<td>321</td>
<td>331</td>
<td>342</td>
<td>367</td>
<td>418</td>
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<td>10.0</td>
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<td>13.3</td>
<td>14.2</td>
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<tr>
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<td>15.4</td>
<td>17.3</td>
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<td>18.4</td>
<td>20.6</td>
<td>23.2</td>
<td>25.3</td>
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<td>Belgium</td>
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<td>72.5</td>
<td>74.6</td>
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<tr>
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<td>64.7</td>
<td>66.0</td>
<td>67.0</td>
<td>66.9</td>
<td>68.2</td>
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* Converted at yearly average exchange rates

points of contact between customers and bank, prompted by major overhauls of incompatible legacy systems undertaken in response to the perceptions of a major Y2K threat. PCs offered a flexible way of providing and enhancing computer resources for a wide range of applications. Simultaneously, widely available packaged software reduced the need to devote in-house resources for the development of general application systems. Incorporating, standardizing and exploiting IT-based innovations became a key issue in banks’ long-term strategies. Moreover, IT applications offered banks greater anticipated advantage thanks to expectations of enhanced control of financial and strategic resources.

Within organized markets new and powerful applications developed to handle the security required by high-volume payments. IT-related change became critical to support the unprecedented increase in the speed, quantity and quality of information about cross-border transactions in organized markets such as those taking place in the Euromarkets. Reforms in the US during the mid-1970s effectively allowed US-based off-shore activities and by end of the decade New York regained its position as a significant international market place. The 1980s also saw the emergence of Tokyo, Hong Kong, Bahrain, Nassau and Singapore as secondary financial centres specializing in non-European-currency denominated bonds like Australian dollars and Korean wons.

A very important event for organized markets was the lending crisis in the less-developed countries (LDC-debt), which originated between 1978 and 1982. First, banks were forced to make substantial provisions against bad debts, triggering the need for banks to become more selective in lending and forcing regulatory authorities to re-examine capital adequacy levels. Second, big non-bank corporations based in industrialized nations found themselves with better credit ratings than banks which, in turn,
allowed them to finance directly from markets rather than through traditional intermediaries (bank disintermediation). Banks were pleased to arrange this process since it eliminated a burden on their capital. At the same time, in emerging and non-industrialized Western economies, governments turned to domestic debt markets to finance the increasingly burdensome service of foreign debt.

The result of these processes was tremendous growth (in terms of issues and financing) of organized markets. According to Hayes and Hubbard (1990), between 1965 and 1967 lead managers in eurobond markets placed an average of ten issues per annum (each of $300 million dollars approximately). By 1976–78 lead managers placed an average of 70 eurobond issues per annum (equivalent to approximately $3,000 million dollars). Between 1982 and 1986 lead managers had an annual average of 500 issues, each valued around $40,000 million dollars.

Meanwhile, the most important consequence of the drive towards mass delivery of retail financial services during the diffusion period was that banks effectively moved from being places of decentralized personal relationships to ones run by institutional managers. During the diffusion period, banks began to create relationship databases instead of using skilled personnel at all points of contact with customers (BBC 1995). For example, Lesley Taylor (Head of Direct Banking, Royal Bank of Scotland) claimed that current technology allowed one person to develop in three or four weeks the skills that previously required five years in the job (BBC 1995; Morris 1986: 97). Information technology applications, therefore, promised higher organizational flexibility to those banks that could effectively implement technical changes.

The second effect of technical innovations on banks’ approach to business during the diffusion period pertained to distribution capabilities. The branch network retained its primacy almost entirely as the point-of-sale for financial services, with most transactions accomplished by non-branch service channels. This trend was facilitated by the advent of digital communications technologies and networks, which allowed the performance and reliability required for organization-wide integration of data resources as well as more effective extra-organizational networks.

The integration of services around digital networks (ISDN) and greater use of electronic data interchange (EDI) protocols were at the heart of new distribution channels such as electronic fund transfer at point of sale terminals (EFTPOS), telephone transfer systems and smart cards. Card technology evolved to provide individual customers with borderless services, primarily under the member-owned VISA and MasterCard International networks.

Table 3 illustrates the growth in the adoption of point of sale terminals and in turn, this growth reflected how IT applications were used instead of cash registers and telephone credit authorizations. Other innovations included cheque verification terminals and fund transfer terminals.

New distribution channels allowed banks to supply more services and this had dramatic effects in banks’ cost structures. The move from more to less expensive distribution channels was possible because the same information or transaction could be delivered in a number of ways. However, not all substitutes for branch-based service enjoyed immediate success (McNamara and Bromley 1997). Cheaper processes were an insufficient condition for reduced cost structures because technology opened the way for banks to improve their cost structures provided customers and agents changed their behaviour according to banks’ expectations.

For example, growth of the most sophisticated EFTPOS terminals was hampered by conflicts between retailers and banks about the inadequacy of cash and cheque handling relative to the banks preferred electronic transactions. Also, there were arguments about the division of costs and profits in the shared systems reflecting underlying differences over who owned the customer, banks or retailers. As a result by the end of the 1980s, EFTPOS had yet to fulfil its potential and develop into a major new source of profit for banks’ fee income (Channon 1988: 317; Wood 1989: 5).

All types of financial institutions invested heavily in the integration and standardization of internal systems during the 1980s. Progress, however, was uneven because banks had traditionally operated through their own closely controlled retail branch networks while the use of third and second parties as agents were more popular in the building society or insurance sectors. At the same time, high trans-

Table 3. Growth of EFTPOS terminals in four OECD countries, 1988–95
(Number of terminals per million inhabitants)

<table>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Belgium</td>
<td>1,925</td>
<td>2,477</td>
<td>2,828</td>
<td>3,213</td>
<td>4,034</td>
<td>5,246</td>
<td>6,294</td>
<td>7,174</td>
</tr>
<tr>
<td>France</td>
<td>2,154</td>
<td>2,842</td>
<td>3,180</td>
<td>3,568</td>
<td>5,594</td>
<td>7,435</td>
<td>7,574</td>
<td>9,394</td>
</tr>
<tr>
<td>UK</td>
<td>426</td>
<td>1,311</td>
<td>1,916</td>
<td>3,299</td>
<td>3,806</td>
<td>4,639</td>
<td>5,993</td>
<td>8,647</td>
</tr>
<tr>
<td>US</td>
<td>183</td>
<td>200</td>
<td>240</td>
<td>348</td>
<td>450</td>
<td>759</td>
<td>1,440</td>
<td>2,107</td>
</tr>
</tbody>
</table>

action costs resulted in low international interconnectivity of payment systems. The established framework handled urgent high value payment well, but achieving potential economies of scale in small payments was deterred by some countries lagging in the use of automated clearing systems, regulation or concentration in bank markets (Wood and Erturk 1996: 15–16).

New technology allowed the introduction of new services and in turn, new retail bank products brought the bank service away from the branch and closer to the customers by delivering customer information at the point of sale. Banks had no proprietary hold on this technology and at the same time, retailers started to offer their own credit services with store payment (account) cards and credit cards. A classic example of an originally non-financial firm offering financial mediation services was the experience of Sears, Roebuck & Company (see further Christiansen 1987 or Ghemawat 1984). In 1982 the US-based firm was the world’s largest retailer (Ballarin 1985: 117). As part of its diversification strategy, Sears purchased an investment house (Dean Witter Reynolds) and a real estate broker (Coldwell Banker). Sears tried to provide full financial services through in-store sites (called Sears Financial Centres) by pulling together its new acquisitions with previous finance business including own-brand credit card (Discover Card) and insurance (Allstate Insurance Co., established in 1931). In other words, Sears tried to create a one-stop department store by integrating:

- customer information and administration;
- different retail sales and financial services within floor space in stores;
- customer support and sales of volume-oriented financial markets;
- the strong brand name of Sears; and
- Sears’ corporate culture.

However, by 1984 outsiders began voicing doubts about the strategy (Ballarin 1985: 122). The expected synergy had not materialized while the core retail operation had lost competitiveness and market share. At the end of 1992, a record $160 million dollars loss resulted in the financial services group being sold piecemeal for a total of $4 billion dollars. The divestiture provided Sears with much needed debt relief, reducing its outstanding debt to $17 billion dollars.4

The divestiture of the finance side ended Sears’ attempt to capture financial products with retailing. It could be argued that Sears was making the same mistake as banks by delivering exclusively through branches (Crane and Bodic 1996: 115). Alternatively, it could be argued that conflicts in corporate culture were a barrier to synergy (Ballarin 1985: 122). However, either explanation was challenged by the success of a more focused approach to retail finance by retailers like Marks and Spencer or by the synergies with branches and supermarket stores explored by US banks like Wells Fargo or Banc One (Channon 1996: 5). In other words, despite its failure to consolidate, Sears’ case was the first attempt to achieve a supermarket in financial services and the prime example for the blurring demarcations in the functions of banks and non-financial intermediaries. Moreover, Sears’ entry strategy was not necessarily that of a price cutter. Instead, Sears’ managers expected synergy to develop by building financial services around an established customer base.

In brief, during the diffusion period IT applications resulted in extending customer options in terms of channel and location in engaging in financial transactions with their main bank but also competing banks. Together with regulatory change and theoretical advances allowing more detailed measurement of credit risk, technological innovations put a premium on financial information rather than on transaction processing capability. Developments in IT were instrumental in lowering entry barriers to bank markets by providing scale benefits to the smallest providers through open membership and third part outsourcing. Applications of IT also threaten to turn retail bank branch networks into sunk (i.e. irrecoverable) strategic costs. During this period IT developments augmented the range of financial services and product availability by increasing the threat of substitution and by lowering the cost of ‘me too’ strategies. Moreover, during the diffusion period, digitization and standardization of IT applications helped to develop markets for second and third party processing. Unfortunately, progress to achieve all potential opportunities opened by technology was slow to come because, although technology allowed new entrants to contest markets for financial services, these challenges took place only in the most profitable segments of bank markets (such as credit cards or unsecured lending).

The rise and fall of the ‘virtual’ bank (1995–2001)

Table 4 summarizes some of the most important recent IT applications in retail finance namely ATMs, telephone banking and ‘electronic’ banking. Partial success of most of these applications questions whether technological change in the Digital Age5 (as opposed to those in the Information Age6) offers new forms of competition and business models in bank markets. Commercial banks have coped with technological innovation and accomplished intended objectives with varying success. Technology has opened the way for banks to improve their cost structures provided they could induce customers to change their behaviour in the intended direction. At the same time, there have been uneven effects from the same technological innovation across distinct geographies.

As noted by Pennings and Harianto (1992), the propensity of banking organizations to adopt technological innovation evolves around the fitness between the new application and the resources, capacities and capabilities which organizations have accumulated over time. Banks have had no proprietary hold on most of their technology
Table 4. Key technological innovations in electronic retail finance, 1979–2001

<table>
<thead>
<tr>
<th>Year</th>
<th>Name</th>
<th>Characteristic</th>
<th>Contribution</th>
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<tbody>
<tr>
<td>1979–85</td>
<td>Telephone banking</td>
<td>Branch-less retail intermediaries</td>
<td>Multi-channel distribution system for banks based on an integrated customer account and information system. Facilitate small-value retail transactions with the potential to substitute central bank issued notes and coins. Formulate ways of collecting broad array of information from customers.</td>
</tr>
<tr>
<td>1988–96</td>
<td>Mondex cards</td>
<td>Debit card with re-writable micro-chip</td>
<td></td>
</tr>
<tr>
<td>1989–98</td>
<td>DigiCash (NL)</td>
<td>Electronic only medium of exchange and unit of account</td>
<td></td>
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</table>

Source: own estimates

Table 5 summarizes elements which explain the apparent inability of IT innovations to engineer increased specialization.

and this has been notably the case with the technology fuelling the growth of the latest applications (such as Internet banking or middle-ware solutions). Some established participants in bank markets have responded by offering non-traditional services like holiday travel (e.g. Midland and Thomas Cook) and real estate agencies (e.g. Lloyds’ Black Horse Agencies). However, the vast majority responded through new service offerings in core areas and by increasing the diversity in their products in terms of markets and customer groups. A few banks such as HSBC, BBVA, BSCH, ABNAmro, Deutsche Bank and Citigroup also increased their geographic scope, often on a narrow range of activities. However, many banks found little joy in cross-border retail growth. For instance, most major UK banks (i.e. Lloyds, Barclays and NatWest) divested foreign operations as they failed to match the returns available in home markets. Participants in bank markets have thus tried, through technology, to increase their share of customers’ financial spending by integrating retail and financial services into ‘one-stop’ shopping. They have generally sought to expand scale sensitive volume-oriented sales and differentiate on the basis of their brand name and corporate culture.

As suggested by empirical research documented in Bátiz-Lazo and Wood (1999: 25), focus on traditional markets and the creation of new customer groups within geographical markets, reflects commercial bank managers’ preference to accept a degree of cross-subsidization in return for the increased stability of multi-relationship customer bases. Although managers of banks expect software and hardware developments to enable close control of their bank’s main profit drivers (ibid.: 25), only a handful of participants in the world have developed IT applications that provided detailed and reliable profitability reports that discriminate effectively between alternative strategies (Holmsen et al. 1998: 85). Diversification and greater asset size, therefore, are a solution to managers’ inability to track key economic drivers for individual distribution channels, service/product offerings, customer group and individual customers.

Concluding that greater diversification and scale are the way forward for financial service organizations in general and banks in particular, is reasonable given that managers of banks have failed to take full advantage of opportunities created by IT innovations. However, there is an apparent paradox when greater diversity and asset size, mainly a product of acquisition rather than organic growth, are pervasive despite technological change, because the expectation that IT innovation should result in greater specialization being the typical business model for participants in bank markets.

The successful use of digitalization by wholesale payment systems and the potential for retail transactions to follow suit, led many (e.g. Browne and Cronin 1999; Taylor 1998; Koerner and Zimmermann 2000; Zimmermann and Koerner 1999) to conclude that the ‘virtual bank’ would be the typical organizational form for financial intermediaries. Although the ‘virtual’ bank is still a broadly defined concept, there is some general assumption for ‘virtual’ to reflect a tendency towards the prominence of non-proprietary, computer-based networks that enable a total digitalization of financial transactions. As a result, non-finance providers would acquire a low sunk (i.e. irrecoverable) cost capability to disintermediate established providers in bank markets. Table 5 summarizes elements which explain the apparent inability of IT innovations to engineer increased specialization.
Table 5. Competition in bank markets and technological change, 1995–2001
(Likelihood the ‘virtual’ bank will be the typical organizational form in banking)

<table>
<thead>
<tr>
<th>Dimensions of IT Innovation</th>
<th>Limitations for electronic-only retail commercial banking</th>
<th>Potential for electronic-only retail commercial banking</th>
</tr>
</thead>
</table>
| Innovation in service offering | • Each new technological innovation accounts for (proportionally) smaller reductions in price differentials.  
• Bank customers remain unwilling to pay for interfaces for the new technology, while merchants expect to share the revenue of new payment media through lower commission charges.  
• Defection rates remain low thanks to the inertia of bank customers, which, historically, has been high.  
• Unknown brand name and associated high marketing expenditure (to attract long-term core deposits).  
| • Greater price transparency.  
• Greater convenience to customers (including congenial resolution of complaints through electronic media).  
• Each customer segment interacts with the bank through the most cost effective distribution channel.  
• Innovations (such as smart cards and digital cash) that circumvent banks’ proprietary networks with alternative distribution or payment systems.  
• Creation of new customer segments and improved relationship banking. |
| Operational function innovation | • The possibility of scale economies make it very hard for potential entrants to catch up, even with technically better systems.  
• Continued importance of contextual non-standardizable elements to assess risk  
• The potential for fraud, money laundering and systemic failure requires supervision, regulation and minimum capital requirement.  
• More specialized (and expensive) labour force.  
| • Enhanced financial performance due to reductions in overhead expenses, which are not offset by reductions in revenue or increases in other expenses.  
• Standardization of activities in payment and lending services eliminate the uniqueness of banks’ proven expertise and ability to control losses from payment activities efficiently.  
• Access to a much wider base of depositors and high rates of asset growth. |


Although most of the elements in Table 5 have already been discussed throughout this paper, Table 5 also suggests other deterrents to the conclusion that the ‘virtual’ bank will be the typical organizational form for financial intermediaries. These deterrents include regulatory innovations as well as banks’ position of advantage based on the transferability of skills between managing payment systems and lending. However, Table 5 also indicates potential strategies within retail bank markets. For instance, the learning effects of the latest technologies have yet to be exhausted. Indeed, systemic studies of Internet bank performance are in need of making clear distinctions between ‘pure play’ and ‘click and mortar’ approaches (DeYoung 2001: 60). Another potential strategic course of action could build on IT enabling the standardization of activities in payment and lending services. Once again, however, Table 5 suggests that the success of that course of action could be limited because of the pervasive importance of contextual elements in risk assessment (McNamara and Bromley 1997) hinders the growth potential of standardization.

In brief, payment systems still rely on bank deposit transfers and central bank-issued money as a medium of exchange. This suggests that in the foreseeable future the complete substitution of notes and coins issued by central banks by digital systems running in high capacity communications medium through computers is unlikely. Transactions involving e-commerce, m-commerce or WebTV have the potential of re-introducing privately issued currency, particularly in applications where customer hold is high such as commuter transport. Computer applications also have the potential to standardize lending decisions but only when making managers judgement redundant for risk assessment. Generally banks have been strongly positioned as administrators of local and international payment systems and the transferability of skills (between managing payment systems and lending) gives banks a strategic advantage. In the foreseeable future, this position is unlikely to be seriously challenged just as central bank-issued currency is unlikely to be replaced by digital currencies. However, the expected growth in the volume of payment and banks’ lack of proprietary control of technology suggest that potential threats of entry to bank markets will persist. Indeed, at the time of writing, there are still lessons to be learnt on how best technology can be applied in the production and distribution of retail financial services.
DISCUSSION

This review set out to determine whether technological change enhanced the importance of computer systems in the strategic compass of commercial banks. One early expectation was that banks’ strategic goals would seek to change and look to modify the principal-agent relationship between bank and customer, so that client–bank relations depend less on loyalty and service quality (i.e. idiosyncratic investments) and more on financial margin. There is evidence to suggest that in a historical perspective, technological innovation and, in particular, increasing applications of telecommunications in bank markets such as telephone banking, electronic cross-border payment systems or wholesale payment systems, have effectively modified the external and internal nature of the banking organization.

However, the way in which future technological innovation is likely to modify banking organizations, both externally (product or service) and internally (operational function), continues to be uncertain – if only because it revolves so much round the strength of customer hold and the strategic determination of a range of potential contestants for bank markets. Externally banks are challenged to service the growth in the volume of payments through e-commerce, m-commerce and WebTV but historical evidence suggests that very few IT applications have led to immediate transformation of business practices in bank markets. Indeed, some of the most promising innovations have failed significantly. Smart new software applications and innovative hardware interfaces which link new ways of making payments (e.g. Mondex or VISA Cash) with conventional payment systems are likely to co-exist and influence the way customers enter the banking system but gestation periods are long rather than short. Banks will continue to be pressed to resolve operational issues in terms of individual customer risk and individual customer profitability while, at the same time, continuing to increase size and diversity. The pre-eminence of conservatism in consumption patterns for retail financial services will continue to limit the success of the most promising technological developments.

Internally, technological innovations have increased the leverage of superior processing relative to capital and other physical resources. Changes in technology have lowered transaction costs for processing financial transactions and some banks have been very effective in implementing those innovations. In the future, hardware and software are expected to provide the platform that will improve banks’ multi-channel management while reducing the cost of coordination. However, at present, it is uncertain whether the solution to banks’ operational problems will result in

- a combination that allows product/service and channel managers to negotiate deals independently.

Throughout the technology innovation process, banks have shown that they lack full proprietary knowledge and capabilities to successfully develop new technological solutions. This suggests that alliances between banks and technology providers have greater chances of success than efforts unique to commercial banks or unique to technology providers. Managers of banks are thus challenged to excel in the implementation of these IT-based strategies. Otherwise, poor execution will result in few ‘ex post’ options and low sustainability of competitive advantage.

On the other hand, technology helped non-bank providers to enter banking but in selected areas such as credit cards and unsecured lending. Anecdotal evidence suggested that technological change in general and digitalization in particular, could have been instrumental in reducing price differentials and increasing transparency in organized markets as well as helping to create new customer segments (through relationship databases). Future fieldwork should try to determine the true extent to which technology has allowed managers of banks and non-banks to segment relationships by profitability as well as providing the basis for the development of new distribution channels (e.g. customer group diversification). This assessment, however, will have to determine how possibilities dealing with the transfer of capabilities between lending and managing payment systems encourages managers of non-banks, who wish to take advantage of the growth in the volume of payments, to create new capabilities as a way to sustain entry in bank markets. Moreover, future research should make clear distinctions in the financial and strategic successes between ‘pure play’ and ‘click and mortar’ approaches.

In brief, the full move away from the branch-centred organization into ‘virtual’ banking will require new IT applications, new managerial practices and new consumption patterns within the banks’ most profitable market segments. Managers of banks (and non-banks wishing to enter bank markets) are now challenged to design internal systems that provide greater control of the profitability drivers and which enable their organizations to capture new synergy.

ACKNOWLEDGEMENTS

Dr Báñez-Lazo benefited from the financial support of Conacyt (Num. 82619) in the early stages of this research. Research support from Jackie Fry, comments and suggestions from Sally Aisbitt (Open), Chris Holland (MBS), Robert Locke (Hawai’i, Manoa), participants at the Financial Information and Systems Annual Conference, Twelfth Accounting, Business & Financial
Conference and anonymous referees are gratefully acknowledged. The usual caveats apply.

Notes
1. Unless otherwise stated, this section borrows freely from Cassell (1984: 62–87) and archival search of the Board Meeting Minutes (1941 to 1965), Minutes of the Finance and General Purpose Committee (1941 to 1965), Minutes of the Annual General Meeting (1923 to 1962) and Notes to Meetings of the Board (1962 to 1976) from the Co-operative Permanent Building Society.
3. With the effect that ‘The banker as a man of stature had been lost.’ (Interview with senior executive of Lloyds Bank Group, 3 March 1995).
5. Starting in 1977, with the introduction of the Apple personal computer.
6. Starting in 1948, with the invention of the first programmable computer.
7. Even for credit cards where the formalities of changing suppliers are minimal customer retention rates have also been high historically. See recent surveys for the UK credit card market in Gilmore (2001) or Báriz-Lazo et al. (2001: 875).

References


