



Technological Innovation and the U.S. Banking Industry: Innovation in the U.S. Retail and Wholesale Banking Sectors

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ABSTRACT. *In this paper, case studies of "best practice" retail and wholesale banks are used to explore the influence of technological change on the banking industry. The impact that specific technologies are having on the retail and wholesale sectors is discussed. Briefly, the evidence shows that there is tremendous pressure on the banking industry to restructure at the current level of technology and competition. Retail banks are looking to client-server, open systems, groupware, workflow software, and imaging technology to restructure and consolidate their operations. Wholesale banks are using information technology to support specialized fee-income generating strategies. Nonetheless, in both the retail and wholesale banking sectors, nonbank financial service providers such as pension funds, insurance companies, money market funds and mutual funds are gaining market share. As these competitors expand their role, I find that the financial services competitor with the best strategy and technology is increasingly no longer a traditional bank. Copyright © 1996 Elsevier Science Ltd*

Introduction

The hypothesis of this paper is that banks today must rethink the way they operate and the way they define their mission simply in order to succeed.

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Advances in computer processing power, software development, global communications networking, and international competition are transforming banking markets and operations. The questions these circumstances raise go beyond — how profitable have banks been in the last quarter, or last couple of years? (though that is important) — and focus on; what is to become of banks and banking in the next 10–20 years, given the revolutionary nature of the changes now underway?

Helping to address that fundamental question and to place this study into context are some typical statistics from a recent American Bankers Association Report of the Market Share Task Force:¹

- Banking's share of total financial assets held by the financial services industry dropped from 40 to 23% over the past 20 years.
- The share of household financial assets held in bank deposit instruments dropped from 34% in 1973, to 20% in 1993.
- Bank time deposits have grown at an average annual rate of 5% over the last 10 years, while stock and bond mutual funds have grown at an annual average rate of 29%.
- The ratio of commercial paper to bank commercial and industrial loans has grown from 12% to nearly 35% over the past 10 years.
- And lastly, the ratio of finance company business loans to bank commercial and industrial loans has grown from 30 to 69% over the past 10 years.

This study seeks to provide detail on how and why these changes are occurring. The focus is on the role of technological innovation as a driving factor. Past studies, reports, and expert opinion are culled in order to provide a detailed analysis of the nature and content of these changes. Examples of leading retail and wholesale banks are used as a case study proxy to clarify the analysis.

General Parameters of Technology in Banking

A recent study by Ernst & Young and the American Banker estimates that the level of investment in technology by commercial banks during the 1980s grew at a compound annual rate of 13%, then dipped to 2% from 1990 to 1992, and increased again to 6.5% in 1993.² A separate survey shows that the compound annual rate of growth in investment in information technology by the entire banking industry from 1981 to 1989 was 27.9%.³ That number was substantially higher than all but one of the other service industries surveyed, which included telecommunications, wholesale trade, retail trade, health care, and air transport (see Fig. 1).

In real terms, the numbers are just as striking. The total expenditure by banks on information technology in 1993 was \$15.3 billion.⁴ The value of the banking industry's information technology capital stock already in place in 1991 was \$28.5 billion. As a percentage of revenues, that represents a higher proportion than was the case in the wholesale trade, retail trade, health care, air transport, or the insurance industries.⁵ In fact, it has been

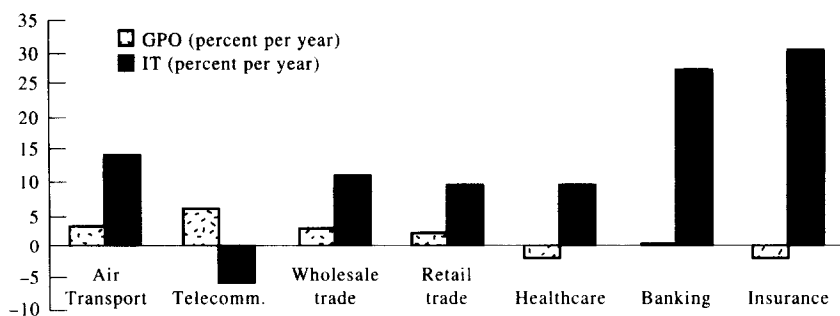


Figure 1. Comparison of U.S. Service Industries, 1981-1989. KEY: GPO: Average Annual Rate of Change in Gross Product Output Per Labor Hour. IT: Compound Annual Rate of Growth in Investment in Information Technology. Source: *Information Technology In The Service Sector* (Nat'l Acad. Press, 1994), P. 8.

reported that the financial services industry accounts for one-sixth of the dollars spent globally on technology and information systems.⁶ While employing only 5% of the U.S. work force, the banking industry's information technology purchases accounted for 35% of the nation's information technology products in 1987.⁷

Data Issues, and Brief Review of the Empirical Literature

Despite these impressive numbers, however, few public data are available to show the *nature of* and *level of return on* these significant technology investments that banks have made.⁸ Also, statistical tests, such as cross-sectional or longitudinal data analyses, that may demonstrate the influence of technical change on bank operations have encountered difficulties due both to the unique nature of bank production processes and the weaknesses of the available data. Each of these points are discussed below because they illustrate important issues that arise in any analysis of technical change in banking.

With regard to the data, while data are available on the level of banks' information technology investment, they are not available *on banks' internal measurements of its actual effect*. Such data has been unavailable because of their proprietary nature and, more likely, because they require or presuppose a basic understanding of where and how technical changes are occurring in the first place. In addition, the most likely substitute for an on-site survey of bank operations, the Federal Reserve Board's Functional Cost Analysis program (FCA), is not an appropriate tool for the study of technical change in banking. The FCA uses a different sample of banks from year to year (depending on which banks volunteer their data, which has an approximate 15% turnover), and aggregates its data into three broad categories according to bank size: small, medium, and large. The aggregation of the data into these three categories and the changing sample conceal important

structural differences across different types and sizes of banks. These distinctions represent important deficiencies in the data since, as argued below, the manner in which banks employ and respond to technological innovations is directly related to the structure and focus of their operations.

With regard to the second point, an overview of the econometric literature in banking reveals notable insights into the probable impact of technical change on banking. While a thorough review of the body of econometric literature is outside the scope of this article (though it has been reviewed elsewhere),⁹ for our purposes, it is important to note that there are fundamental disputes in the literature regarding (1) the best way to model and define bank production processes *and* (2) by extension, the best way to measure and quantify the nature and content of technical change in banking. The disputes of course mirror the disagreement among applied economists in their approach to and conclusions about the best methods to model and evaluate service sector productivity and innovation. As with most service sector industries, the relative cost and profitability of complex banking systems, products, and services that are now available have yet to be systematically modeled and analyzed. That type of analysis is required before the influence of technical change on these same bank services and production methods can be completely understood.

Nonetheless, the most recent empirical findings appear to support an early consensus with regard to the level of X-inefficiencies in banking, and these findings can offer important insights into the role of technology in banking. X-inefficiencies are deviations from the efficient frontier and represent the differences in managerial ability to control costs or maximize revenues. Research to date suggests that X-inefficiencies account for on the order of 20% or more of costs in banking, while scale and product mix inefficiencies, when they can be accurately estimated, are usually found to account for less than 5% of costs.¹⁰ In other words, there appears to be strong empirical evidence that many banks are managed inefficiently. While the literature has been able to determine this, it has not been able to determine *why*. Of course, one may hypothesize that the X-inefficiency findings point to the potential use and value of the innovations in information and production technologies. Indeed as these innovations are outlined in the case studies to follow there appears to be some support for that view.

The notion that information technology can transform banks and banking must however be tempered based on separate findings in the literature regarding bank cost structures. According to the literature, operating costs — which include wages, fringe benefits, physical capital, occupancy, materials cost, and management fees and data processing expenses — are on average only approximately 25% of total costs in banking. The remaining 75% of costs are accounted for by *interest expenses*, including interest paid on purchased funds and on core deposits. Furthermore, this ratio changes with the size and type of bank under consideration, though throughout interest represents by far the largest proportion of bank costs. The implication, for an evaluation of technology in banking, is quite simple: since operating

costs represent the cost base that will be most affected by technical change, *such change, however rapid, will necessarily have a less than proportional impact on total costs in banking.*

A few points can and should be made, however, regarding the hypothesis that banking is being transformed due to technological innovation. *First*, given the specific focus of the case study analysis that follows, it is not designed to generalize about bank efficiency and productivity trends *industry-wide*. Indeed, the strength of the case studies is in their illustration of *highly specific applications of technology in banking*, and it is these applications that — regardless of present cost structure constraints — appear to support the prediction of gradual, profound change. *Second*, while production technologies may precipitate fundamental changes in banking over the *long-term*, these changes can also appear only marginal *at any one point in time* against the backdrop of banking's industry-wide cost structure. While naturally the *long-term* effects of the bank production changes described here are not easily fathomed, surely current cost-structures alone are not a sufficient basis to rule them out. *Finally*, returning to the X-inefficiency findings, it turns out that according to the literature the most significant contributing factor to these inefficiencies are *technical* as opposed to *allocative* inefficiencies.¹¹ In other words, rather than choosing poor business strategies, banks appear to be highly ineffective in carrying out the effective strategies that may exist. This raises important questions. At the outset, do these X-efficiency findings suggest that there is room for significant improvements in the tools and methods used by bankers to manage their operations, which is another way of saying information — since information management is at the core of banking? And if so, is there a role for the information technology innovations described in the case studies to achieve that task? And if there is a role, what is it, and how will it play out? Such questions naturally lead us to want to learn more about what is actually happening at the interface of technology and banking. To that task we now turn.

The Data Appears to Show ...

At the aggregate level, the data shows that U.S. banks have succeeded in cutting employment costs and boosting productivity while at the same time investing significant sums in technology. Once again, however, how or if causality runs in this set of circumstances is not apparent. Some reports indicate that more than 300,000 banking jobs have been eliminated since 1984, and the revenue per employee has increased by approximately \$20,000.¹² According to a recent McKinsey & Co. report, U.S. retail banks enjoy a productivity advantage of nearly 50% over their German and British counterparts, with the lead attributed to the higher level of technological innovation that is unique to the more fragmented U.S. financial services markets.¹³

The ultimate success of innovative banks will turn on their ability to adapt

new technologies to new strategies in a cohesive manner. The following analysis is broken down into the retail and wholesale sectors, highlighting the distinct influence that particular technologies have had on the operations of leading banks in each.

Technology and the Retail Banking Sector

Retail banks operate primarily in local markets with a consumer-oriented retail business. Retail banks can be broken down by size into community, super-community, regional, and super-regional banks. This section focuses on the leading regional and super-regional retail banks. The retail sector accounted for as much as 71% of the total employment in the U.S. banking industry.¹⁴

The significance of technology investments to the retail banking sector is difficult to overstate. In 1993, banking institutions overall spent \$3.22 billion on information technology. More than one-third (\$1.11 billion) was allocated to retail delivery mechanisms, more than that allocated to any of the other categories in the survey, including data centers (23.3%), departmental systems (21.7%), telecommunications (10.5%), and item processing (7.2%) (see Fig. 2).¹⁵ A study on productivity in the financial services industry, commissioned by the Alfred P. Sloan Foundation, and now underway at the University of Pennsylvania's Wharton School of Business, predicts that retail delivery will be the core element of banks' competitive strategy.¹⁶

The influence of technology on retail banking is discussed here according to first; its affect on *internal retail banking operations* (generally origination), and second; its affect on *retail service delivery*. By segmenting the analysis in this way, the question of whether technology helps to retain and acquire profitable customers, or whether it enables new products to be delivered more efficiently is addressed head-on.

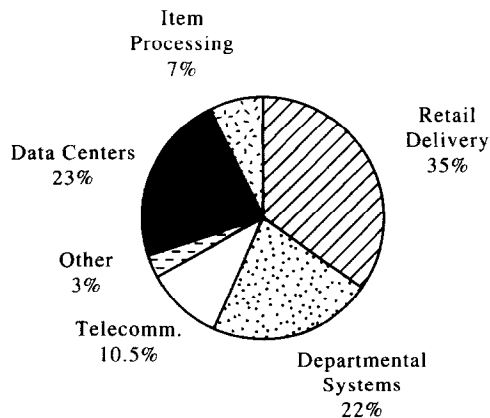


Figure 2. Bank Technology Investments, 1993. Total \$3.2 Billion
Source: "Banks Will Invest Their Dollars in PC-Based Solutions,"
Financial Technology Review 1 (May, 1994), p. 14.

Internal Retail Operations

Internal operations comprise mainly “core systems” which are used to manage customer information. They are the backroom transaction and account processing functions which represent up to 80% of a typical retail bank’s workload.¹⁷ Core systems are currently being reengineered to allow *customer-centric* rather than *account-based* information retrieval. The influence of technology is discussed below first in terms of managing customer information and second in terms of transaction processing.

Technology improves the quality of information available to managers for decision-making in two ways.¹⁸ First, information technology allows the retail bank to retrieve and analyze vast amounts of customer-related data based on the customer’s use of various products and services. Second, using this data, the retail bank can more efficiently determine customers’ current and future integrated financial needs, the most lucrative customer segments, and the most profitable products and product combinations. There are three technologies driving innovations in information retrieval and analysis: *client-server*, *open systems*, and *groupware*.

Client-server — Client-server applications are software programs that give users flexibility in choosing and consolidating information that is otherwise disparately available on mainframe and personal computer terminals. Used correctly, they can allow the right information to get to the right person at the right time. The standard client-server puts the presentation and logic at the client, and the data base on the mainframe or server. Program codes are not required to access data. Rather, bankers can use client-server to incorporate spreadsheets, word processing, and multimedia-based data applications into their customer documents or files through running networks. Ease of data exchange and analysis makes client-server particularly useful for front-end branch applications. Loan origination, loan processing, and reporting are some of the first tasks being assigned to client-server.¹⁹ The overall flexibility of the system enabled a sample of banks to reduce average project development time from 18 months to 6.²⁰

Open Systems — Open systems are software products that can run on different kinds of hardware platforms, allowing banks to bypass incompatibilities across proprietary hardware and software products. The banking technology market has been vendor-driven which has lead to a multitude of incompatible bank technology offerings, or “legacy” systems. Open systems overcome the incompatibilities and enable banks to use computer systems within and across business units. This allows banks to collect detailed information across customer and product categories, which in turn allows for new categories and tools with which to manipulate the information. As a result, banks can define profitability measures with more accuracy, allowing for improved management methods.²¹

Groupware — Groupware is a software system designed to be used by groups of people in one or more locations. Like client-server and open systems, it combines communications systems that are traditionally separate.

For example, groupware can speed up document preparation by enabling several individuals to edit the same document at the same time from different locations. It can be an essential tool for loan officers working from several different locations. A recent survey shows that groupware is rapidly entering the industry; fully 29% of the industry expects groupware to be widespread by 1996.²²

In short, it is the increased interoperability between different layers of information that client-server, open systems, and groupware provide that will be a key source of banks' future competitive advantage. In fact, at present, retail banks only achieve adequate value (i.e., the line of business creates value above the shareholder's required rate of return — the "hurdle rate") from about 30% of their customer base.²³ Thirty percent of the remaining customers create approximately *zero value*, and the other 40% have *negative expected value*. These conditions — which echo the X-inefficiency findings above — make clear the urgency of improved information management techniques. The unique tools and innovations described will play an essential role in that process. BankAmerica Corp.'s experience below illustrates the level and type of information technology investments that even the leading banks are making to adapt their operations to the new, technological landscape.

BankAmerica Corp.: Backroom Reengineering Leads to Front-End Profits. In 1991, BankAmerica had assets of \$118 billion, employed 54,600 workers, and had transformed itself into a "superplayer" retail bank in the western United States. Bank analysts say that BankAmerica's success may provide a blueprint for true national banking in the United States.²⁴ How BankAmerica got to that point illustrates a leading retail bank's successful application of backroom innovations.

BankAmerica made significant information technology investments to modernize its back-office infrastructure, even during its downturn in the mid-1980s. According to one estimate that ranked the top banks according to their systems technology expenditures, BankAmerica was second, having spent an estimated \$450–550 million on systems technology in 1985, second only to Citicorp, which spent an estimated \$850–900 million.²⁵

From 1989 to 1990, management restructured its account processing system through a joint venture with IBM, which handled the software development. Building on the COINS system (Customer On-Line Information Network), BankAmerica redesigned its record-keeping and information retrieval capabilities by instituting IBM personal computers (PCs) or "smart" terminals to replace "dumb" terminals. A combination of client-server, open systems, and work flow software managed 60% of its retail systems in the new architecture. BankAmerica used outside vendors to manage the some 20 000 workstations it had on operation.

BankAmerica also restructured its customer information files (CIFs), covering 17 million account relationships, with Innovations System Software. It integrated customer-centric and account-based information storage and

retrieval. Using Teradata, the bank created a corporate data storage function independent of the information production function, enabling the bank to sweep the product systems for information updates, access analytical tools, and manipulate data across some 25 million accounts. BankAmerica also developed a single network that connected about 850 branches and service centers via 20,000 PCs and dumb terminals, greatly simplifying product introductions, which could now be made via the network rather than through person-to-person or branch-by-branch connections.

In short, it was not a mistake that BankAmerica set a regional banking standard. It concentrated on what it had done best — servicing profitable retail bank customers in California — and used information technology to do it better, faster, and at lower cost.

Transaction processing is the second basic component of retail banks' core information systems. *Imaging* and *work flow software*, and one business strategy — *outsourcing* — are driving significant changes in this area. In the aggregate, banks are spending as much as 10% of their discretionary funds on technologies intended to redesign transaction processing.²⁶ Outsourcing has become a significant trend in the industry as the complexity and economies of scale in transaction processing have reached unprecedented levels.

Work Flow Software — Work flow software is a routing and control system connected to a computer network to process electronic work or work documents. Its potential is achieved in retail banking when it is combined with imaging technologies and applied to the high-volume, routine transactions that make up traditional retail operations.²⁷ Through the combination of *imaging* and *work flow software*, transaction processing is becoming nearly paper-less and continuous as banks receive, settle, file, and retrieve transactions electronically. Consumer credit and collections systems are particularly affected by work flow software.²⁸ Collection systems use the technology to closely monitor accounts for late payments, automatically send overdue notices, and route accounts to collectors. Used in this way, work flow software reduces costs by reducing the need for employees in transaction processing, and these employees may be reassigned to higher value-added tasks.

Imaging Technology — Image-based item processing allows a paper document to be scanned and then handled electronically, dramatically increasing the speed and accuracy of document indexing, storage, and retrieval. Imaging technology is primarily used in file folder imaging and payments systems imaging.²⁹

Some 200 file folder imaging applications currently exist in the banking industry, concentrated primarily in the larger banks, and rapid growth is predicted.³⁰ "In an image-based environment," writes one information technology consultant, "work flow can be logically redesigned without regard for the paper medium; paper items are imaged and stored, and work can then be broken up and individual images accessed when and where they are needed."³¹ Payments processing — particularly check processing — is

a second area being transformed by imaging technology. About 55 billion checks were processed in 1993, at a total cost of about \$4 billion for proof-of-deposit, and another \$4 billion for posting checks to customer accounts and preparing and mailing statements. Imaging technology is predicted to be a standard part of banks' check processing systems by 1999, and therefore, even if it shaves a few cents off the process, can save hundreds of millions of dollars per year.³²

Outsourcing — As technology and its applications become ubiquitous in the industry, bankers find that outsourcing erstwhile routine tasks is a practical and profitable strategy.³³ Credit card processing and issuance are heavily outsourced, as well as mortgage processing, student loan processing and ATM driving/switching.³⁴ The banks and nonbanks that perform the outsourced functions are specialized and therefore able to increase transaction processing efficiency based in large part on their continuous investment in current technologies. Three case studies follow to show the variety of outsourcing strategies now being employed by leading banks.

The Republic National Bank of New York: Outsourcing Brings Savings. The Republic National Bank of New York, an approximately \$40 billion asset retail bank, outsourced a major portion of its check processing operations to a financial services firm.³⁵ By outsourcing, Republic National will have an operational image capability 1-2 years earlier than it would have had if it had developed the technology in-house. It believes that its imaging capability will be developed at a fraction of the \$4 million it would have had to spend if it were to develop the 200,000 items-per-day system in-house. By outsourcing, the bank will reduce its staff by 50 full-time and 25 temporary positions.

Chase Manhattan Corp.: A \$480 Million Outsourcing Contract. In late February 1995, Chase Manhattan Corp. signed a benchmark 12-year, \$480 million outsourcing contract with FIServ Inc. of Milwaukee, a data-processing and software firm, to outsource its check-processing functions.³⁶ The deal is one of the largest bank outsourcing contracts ever and marks a threshold for the big banks. Unlike regional and community banks, the largest retail banks (or money center banks with considerable retail business, like Chase Manhattan) have traditionally kept check processing in-house because of the volume of their operations and their attendant expertise. Nevertheless, while Chase Manhattan processes a total of 800 million checks per year, or approximately 3 million per day, that is just half the processing capability of FIServ. A long-time specialist in check processing, FIServ has 31 check processing sites across the country and processes approximately 1.7 billion checks annually. In addition, FIServ Inc. intends to incorporate imaging technology into Chase Manhattan's operations, particularly in the proof-of-deposit function, which will generate significant savings once automated since it is at the heart of check processing.

... *And Other Leading Retail Banks Look to AT&T Solutions.* AT&T Solutions, a former subsidiary of AT&T, designs, builds, and manages networks and provides various information technology services and operations. Its clients include Great Western Bank FSB, First National Bank of Chicago, and Chase Manhattan Bank. Great Western Bank, FSB, outsourced its entire frame relay network — local area networks, wide area networks, and applications — to AT&T Solutions. Formerly dependent on a leased line network, Great Western's new frame relay network will link 528 full-service bank branches and another 200 lending offices in 23 states. It will be used primarily for transactions processing and will enable branch operators to perform almost all of the bank's functions, including deposits, loan originations and automated teller machine personal identification number verifications. These tasks will all be accomplished by keying off customer data housed in the bank's central computers. Combined, the applications will cut response time for deposit transactions from 7-10 seconds down to 1-3 seconds in peak hours.³⁷

Retail Services Delivery

Technical innovations, as stated at the outset, are also restructuring the *service delivery* side of retail banking. Product innovation and differentiation, and branch automation, are the two key components of these changes now underway.

Product innovation and differentiation is the segmenting of products along narrowly defined customer lines. Computerized statistical programs and the restructured internal systems that manage customer information described above are driving this process. It enables banks to identify lucrative market segments and to tailor products and marketing strategies to them. In the literature, segmentation of the customer base and the parallel innovation and targeting of diverse products is called "unbundling," and this process has significant implications for the competitive position of retail banks.³⁸

First, unbundling has enabled retail banks to produce, market, and price services and products that were previously sold together. By analyzing the behavior and profitability of key customer segments, retail banks are seeking to target the most profitable customer segments with specialized products and services. Whether these are specifically targeted loans (see BancOne below), or sophisticated savings and investment instruments (such as mutual funds and securities) retail banks are learning to develop more targeted and profitable products.

Second, and perhaps ironically, retail banks are also being *undercut* by the unbundling process. As financial information becomes more accessible and fungible, banks are losing their control over it and, by extension, they are also losing their control over the financial products that can be developed from this information. For this reason, and because banks are constrained by regulations attached to federal deposit guarantees, nonbanks

are emerging as highly competitive and efficient financial intermediaries, and thus “disintermediating” banks.

For example, consider the costs and returns on traditional bank certificates of deposit (CDs) versus mutual funds.³⁹ Due to the small size of the average CD account and its relatively high interest cost, it earns 59 basis points per dollar in revenue. The all-in cost, however, including the direct and indirect functional expense, adds up to about 52 basis points. That leaves a net spread of just 7 basis points. By contrast, retail mutual fund spreads can be a lot higher. The spreads on equity and fixed-income mutual funds come to approximately 23 and 20 basis points, respectively. The higher margins on equity and mutual funds clearly reflect higher risk — namely, the fact that they do not carry deposit insurance — but they nevertheless also reflect the fact that these funds have lower costs and higher revenues. This makes them a significant competitive threat to bank CDs. Indeed, mutual funds now contain approximately \$2 trillion in assets which is not far short of the \$2.7 trillion held in U.S. bank deposits, even though they entered the market in force just two decades ago.⁴⁰ This is clear evidence of banks’ disintermediation.

Fidelity, the largest mutual fund company, has approximately \$200 billion under management. This exceeded the deposits of any money center bank, until the mega-mergers of 1995. Generally speaking, banks have responded by acquiring mutual fund investment companies or by entering into exclusive joint agreements with them. In 1993, Mellon Bank successfully merged with Dreyfus Funds, the third largest sponsor of money market funds and the tenth largest sponsor of other mutual funds. NationsBank gave exclusive rights to Dean Witter Financial to market proprietary NationsBank funds as well as other funds to bank customers from locations in branch offices.⁴¹ Overall, banks increased their holdings of mutual fund assets from 5% in 1987, to 11% by early 1993. By 1992, more than 90% of all banks offered mutual funds to their customers, more than double the proportion in 1985.⁴²

Retail banks may be affected beneficially or negatively by the unbundling process, depending on how they adapt. The BancOne example that follows provides the basic components of a successful adaptive strategy, but also the extraordinary commitment and effective management that is required to implement it.

BancOne Sets a Standard in Product Differentiation and Customer Segmentation. BancOne of Columbus, Ohio, is one of banking’s elite super-regional banks. Referred to as “the best retail bank in America” and “the best little bank in America,” BancOne achieved meteoric growth in the late 1980s under the leadership of CEO John B. McCoy. By 1991, it was six times larger than when McCoy took over. BancOne focused on innovative strategies and technology even while remaining committed to the “bread and butter” of retail banking: middle-market lending and consumer banking.⁴³

BancOne consolidated back-office functions and imposed common products, technology, and monthly report requirements. The standardization inherent to these changes enabled a management reporting system that was able to show *what products work where*, and what exactly *improves* product and customer profitability. That reporting system is now regarded as one of the best in the industry. The innovative master file on customers made BancOne's broad offering of successful products possible by providing information about what their customers were most likely to buy, on the basis of their age and income. Throughout, the focus of BancOne's strategy was in using innovations and technology to bring higher quality and more efficient retail banking service to their core group of retail customers.

According to David Rogers, professor of management sociology at the New York University's Stern School of Business, BancOne "has a formula, a culture, a structure, systems, and an effective senior management group that bear close examination as a model for success."⁴⁴

The second key component of retail service delivery innovation is branch automation. Nonbranch means of service delivery — such as ATMs and telephones — are becoming increasingly popular with bank customers. The Bank Administration Institute (BAI), forecasts that *all* retail customer segments will eventually use nonbranch channels, to varying degrees and for different functions.⁴⁵ Currently, 51% of households use ATMs at least once a month and 49% of households do or would use telephone banking if it were available. Also, the rise in proportion of people owning televisions (75%) and telephone-based equipment that can deliver banking services directly to the home (71%) is significant.⁴⁶

The non-branch delivery mechanisms have also been shown to radically reduce costs on a per-transaction basis. Ernst & Young estimates that the average teller transaction in the U.S. costs a bank over \$1, while the same transaction costs 35 cents by phone and just 27 cents on an ATM.⁴⁷ Computer scientists at Carnegie Mellon University, with funding from Visa USA Inc. and the National Science Foundation (NSF), have developed a system called NetBill that is expected to reduce transaction costs over the Internet to just *one or two* cents per transaction.⁴⁸ Of course, security and privacy questions remain to be resolved, but this cost comparison alone indicates the potential for fundamental changes in banking service delivery methods.

But how does a bank manage the transition from branch to branchless banking? According to the Bank Administration Institute (BAI), banks must "develop a focused delivery approach to meet customer needs," which "clearly define[s] the role of nonbranch channels *either in support of or independent of* the branch network." (emphasis mine).⁴⁹ Banks need to both educate customers about the advantages of their nonbranch options while at the same time finding a wise way to make profitable use of their current branch network. The Wells Fargo example below (drawn from its pre-First Interstate merger experience) provides a fine example of an automated branch network strategy that has worked well.

Wells Fargo: An Automated Branch Network Strategy That Works. Wells Fargo, prior to its recent merger with First Interstate, illustrated the benefits of a focused network branch strategy. A leader in retail services delivery, Wells Fargo offered highly advanced ATMs with access to individual retirement accounts (IRAs), certificates of deposit (CDs), mutual fund accounts, and the ability to pay utility and other bills. The bank had 1844 ATMs in 1994, and kept physical branches down to 624 in the same year, just three more than in 1986. At the same time, core deposits have grown 33%, and net income has grown 124% to \$612 million. Meanwhile the number of tellers and other branch employees has dropped by 1200 since 1993. Most importantly, while calling traditional bank branch networks a "dinosaur," the president of Wells Fargo nonetheless sought to "grow profits using technology to reach new customers — all while not alienating older, wealthier depositors who wouldn't touch a PC if their lives depended on it."⁵⁰

Striking that delicate balance is difficult, but essential. The Wells Fargo example demonstrates that a balanced branch and branchless delivery strategy is not only ideal, but workable too.

Retail Summary

We can conclude from the above analysis that *internally* technology and innovations are enabling customer-centric as opposed to account-based forms of customer information systems in retail banking. Decision-making processes have been markedly improved by the increased speed, specificity, and flexibility of information. The down-side is that retail banks' decision-making processes and transaction processing-systems that are organized around less flexible precepts may be made redundant or even bypassed as more functions become electronic. *Externally*, "unbundling" allows for the segmentation of the customer base and the innovation and targeting of diverse products to increase profits. An important side effect, however, has been the disintermediation of retail banks. All-purpose retail banks find it difficult to compete with the specialized skills and economies of scale provide by nonbank firms. Therefore the current trend toward consolidation among the retail banks with strong market niches will continue. Overall, though many retail banks still have important advantages for particular customer segments, an important question faces them, namely; "What strategy *will* meet *our* customer needs?"

Technology and the Wholesale Banking Sector

As the second principal element of the banking industry, wholesale banks account for approximately 25% of the industry's total employment. Together with retail banks the two sectors account or nearly 100% of employment in the banking industry.⁵¹ The assets of the nation's largest banks account for approximately 60% of the industry's total assets.

The wholesale banks considered here are the major money center banks.

They offer a variety of wholesale investment and credit services, in addition to select retail services. The money center banks are at the convergence of large corporate and investment banking, offering market-making and trading, securities, commercial and industrial loans (C&I), and international investment and financing. The side of money center banks that performs federally insured middle-market lending (commercial banking) is distinct from the side that provides investment banking. The impact of technology is definite and extensive on both sides. Because the underlying trend in the wholesale industry is toward specialized wholesale investment and credit financial services, this analysis necessarily focuses on the investment side. In fact, it is argued that the movement away from commercial banking and toward investment banking is a direct result of the twin pressures of competition and technical innovation that we are discussing here.

Specialized, Global Finance

Wholesale banks in the U.S. are pursuing a strategy of specialization on a global scale. They have cut away peripheral retail functions and have developed specialties in core wholesale services.⁵² As a primary example, wholesale investment banks are now focusing on marketable saving and investment instruments that are developed through securitization. Securitization is the conversion of individual assets into financial instruments by "securitizing" them [backing the financial instrument with the asset(s)] and trading them in specialty markets. Derivatives are a well known, if not well understood, type of securitized financial instrument. In the case of derivatives, the underlying "asset" is a commodity index or other predefined variable that is used as a forward (to fix future prices in the present), swap (to exchange cash flows or modify asset characteristics), or option (to endow the holder with the right but not the obligation to engage in a transaction). In each case, and in every case where securitized assets are used, the investor basically assumes the risk that is tied to the assets price movement over a specified period of time. For that reason, the essential question for the investor is, how well understood is the risk of the underlying asset? If the risk is well-understood and managed, these instruments are a positive development, but if the risk is not well-understood (as recent events have indicated), they are not a positive development.

Ultimately the question of risk, and how to manage it, is the most important consequence of the current drive by wholesalers to specialize. The demand for securitized assets, amongst other instruments, has become the principal driving force behind the adoption of technology in investment banking. The ability of the investment bankers to analyze and understand the *value* of the information flows that the new technologies facilitate will determine whether the technological innovations are productive tools.

Derivatives and other securitized financial instruments, enabled by information technology, have clearly worked to link capital markets, leading to

highly liquid and integrated debt and equity markets. The extent of that integration is significant, as the following facts illustrate:⁵³

- In 1986, the global stock of the principal derivatives — options, futures, and swaps involving interest rates and/or currencies — was \$1.1 trillion. In 1991, it was approximately \$7.0 trillion.
- In 1970, America's securities transactions with foreigners (i.e., gross sales and purchases of bonds and equities involving a resident and non-resident) amounted to the equivalent of 3% of the country's GDP. In 1980, the figure was 9%; *in 1990, it was 93%*.
- Between 1980 and 1990 the volume of worldwide cross-border transactions in equities grew at a compound annual rate of 28%, from \$120 billion to \$1.4 trillion per year.
- Trade in foreign exchange, including derivatives, was estimated at roughly \$900 billion each day in 1992.

Affordable and accessible computer power has been a powerful factor in promoting cross-border flows of capital. Computers have not only made existing cross-border transactions easier, but have also, and more importantly, transformed the ends toward which financial markets are used by banks and non-banks. It is notable — mirroring the double-edged experience of retail banks with “unbundling” — that the increased speed and efficiency of information transfer has greatly expanded the role of non-bank, financial market participants at the expense of traditional wholesale investment banks. Institutional investors, now capable of tracking corporate performance for themselves, have become better capitalized and more skilled in international finance. As a result, the commercial side of money center banks whose traditional advantage was in gathering and sifting information about creditors and debtors, is losing market share. While wholesale banks are pursuing specialized investment and intermediation services, leading to the rise in the investment side of wholesale banks, the commercial side of wholesale banking is in decline.

Notably, specialized investment services in demand by corporate customers around the world have become the province of a few large U.S. investment banks. While five investment banks account for more than 50% of all underwriting and merger-related business in the United States today, these same banks, according to an October 1993 evaluation reported by the *Economist*, are also world-leaders. Of the top five rated global investment banks, the top four were from among the American elite, including Goldman Sachs, Merrill Lynch, J.P. Morgan and Morgan Stanley.⁵⁴

The analysis below dissects the influence of technology on the wholesale investment banking industry according to first; its influence on *wholesale credit services* and second; its influence on *wholesale investor services*.

Wholesale Credit Services

Wholesale credit services include bonds, mortgages, interbank loans, finance company loans, and commercial paper. The principal influence of technical

innovation on wholesale credit services has been — similar to the case in the retail banking market — to fuel the “unbundling” process. In this case, technology has played into the strengths of the investment side of wholesale banks which is more conducive to unbundling, as already mentioned. The major wholesale credit subservices discussed are *origination* (advising the borrower, creating and pricing the debt instrument, and managing the borrower’s liquidity risk), *distribution* (assembling the credit providers), and *asset-holding* (funding the credit, managing the associated liquidity risk, and evaluating, pricing and managing credit risk).

Origination — Advances in information technology have transformed the process of originating financial information and manipulating it. The proliferation of private information networks — such as Quotron, Reuters, and Telerate — have lead to increased availability and affordability of real-time information on global origination markets. Given lower cost, higher quality information processing capabilities, “[a] growing number of borrowers (as well as other financial intermediaries) can develop a cost-effective information and knowledge base, and hence can reduce their dependence on banks and securities firms for origination advice.”⁵⁵

As a case in point, companies are relying more and more on their central treasuries for banking services, and are banking *in-house*. Notable examples are British Petroleum, SmithKline Beecham, and Scott Paper.⁵⁶ In-house banking can reduce banking costs by minimizing the number and size of transactions that the firm has to undertake with banks. Even though specialist expertise remains the province of the top investment banks, in-house banking also offers corporations a unique opportunity to manage their transactions on a day-to-day basis with exclusive knowledge of their own business needs.

Distribution — In this area of assembling credit providers, the well-established customer base of wholesale investment banks and their proven track record support their strong competitive position. Once again, however, their exclusive advantage is being gradually eroded by the democratizing effect of advances in information technology. Much like the private information networks described above, electronic information trading systems for debt and equity — such as Portal, the Crossing Networks, and Spaworks — are pressuring the traditional banks by offering reduced transaction costs for wholesale private placement and securities distribution. The more labor-intensive — based as they are on intensive customer development and traditions of loyalty — distribution systems of the traditional investment banks are being by-passed. Reflecting this trend, the private placement market (which is the sale of debt instruments by firms directly to the market, rather than borrowing from banks, as traditionally occurred) grew tremendously in the 1980s, increasing by approximately *five times*, as shown in the figure below. In 1990, the private placement market accounted for nearly 50% of the total domestic debt and equity issuance market (see Fig. 3).⁵⁷

Asset Holding — Asset holding, as noted, comprises funding, liquidity, and credit risk management. In this area, wholesale investment banks have

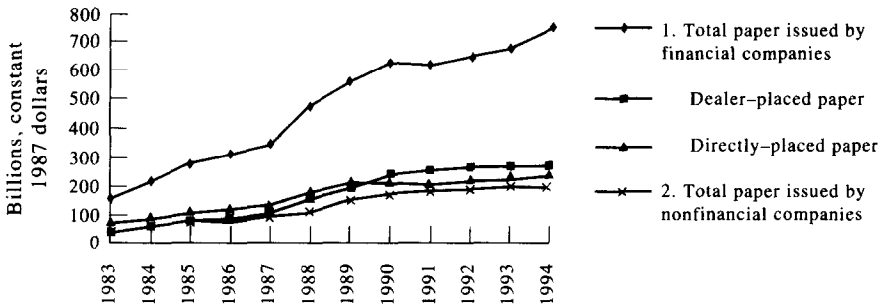


Figure 3. Commercial Paper Issuance, by Issuing Company, 1983-1984. Source: Federal Reserve Board Bulletin, Domestic Financial Statistics, Annual Issues.

again maintained their strong competitive position owing to their privileged access to funding on the basis of deposit base and discount window privileges. Here again, however, advances in computerization have enabled finance and leasing companies to raise funds through commercial paper issuance and other financial instruments. Moreover, nonbanks now use technology that once was essentially proprietary to investment bankers. Computer programs enable sophisticated hedging instruments (like derivatives) which enable new methods for managing risk, if properly used. The combination of new risk management techniques and the reduced transaction costs provided by electronic information and trading networks has led to wider access to credit markets.⁵⁸

The pressure that the new competition and technology have created for even the most established investment banks is nonetheless considerable. The following experience of J.P. Morgan offers insight into the kind of adjustment that *even the best* banks must now prepare for.

J.P. Morgan: Even the Best Must Adapt. J.P. Morgan is one of the premier "niche global" wholesale banks and has incorporated technology into its mission with "extraordinary foresight and success." J.P. Morgan has approximately \$135 billion in assets and has focused on merchant and investment banking as its core business. During a period of about 10 years, J.P. Morgan made what Professor David Rogers of New York University has called "frame-breaking" changes. Faced with a big drop in the corporate loan business, a jolt common to all money center banks given the innovation in wholesale markets, J.P. Morgan redirected its resources "perhaps more than any of its competitors," to concentrate heavily on investment banking-related businesses. Specifically, it focused on services associated with corporate finance and securities trading. J.P. Morgan became a "financial engineer," following its clients into the capital markets in the 1980s and provided the leverage buyout loans and other new products that their clients demanded. But in doing so, J.P. Morgan had to change its *institutional character*.

J.P. Morgan developed new securities-related products and increased its

activity as a trader, developing an entirely new infrastructure in the process. It changed its organization, people, and compensation practices. Several key factors contributed to J.P. Morgan's turnaround according to Professor Rogers of New York University, including:⁵⁹

- An explicit acknowledgment that banking had changed to such a degree that a transformation was necessary.
- Extensive analysis and planning before making any changes.
- An attempt to make the changes while preserving as much as possible of the old culture.
- A tremendous investment in technology and new buildings, both in New York and London to support the new trading and corporate finance businesses.
- Corresponding, though gradual, changes in compensation, in organization, and in personnel to cultivate a new culture in support of the new strategy.

It is notable that J.P. Morgan saw that in order to establish new, long-term customer markets and relationships it had to maintain and cultivate its long-term, *old* customer relationships. In this respect J.P. Morgan's insiders had to walk a delicate line, maintaining the best of the old while cultivating the best of the new business and culture. With regard to technology strategy, J.P. Morgan also did not leave this entirely to outsiders, or "techies." It had a permanent technology investment committee established that consisted of the president, three global markets managers, and the heads of corporate finance, asset management, technology, and finance. Following its commitment to reorganize along new product lines, J.P. Morgan moved from a geographic and product orientation to a cross-functional organization. In terms of technology, this new organization required and led to improved back-office and product linkages. As a result of its technology strategy, J.P. Morgan now has a fully integrated mainframe system that links products, including foreign exchange, spots, forwards, and futures. Another by-product of this reorganization is J.P. Morgan's acclaimed risk-management system. The commitment to innovation continues, as Salomon Brothers forecasts J.P. Morgan's technology budget at \$600 million per year, and growing.

The example shows that J.P. Morgan made a profound shift in strategy, and succeeded. The key point is that organization, strategy, and technology are all deeply intertwined, and as J.P. Morgan understood, it is not possible to manage change successfully if one does not understand how and why each component is intertwined.

Wholesale Investor Services

The market for financial services required by large, wholesale *investors* is also undergoing substantial change.⁶⁰ A broad range of service providers compete with wholesale banks including life insurance companies, independent investment advisors, specialists in information and communication

technologies, foreign banks and securities firms. To evaluate the role of technical change in driving this change, the field of wholesale investor services is broken down into *investment advice and management*, *trade execution*, and *custodial services*.

Investment Advice and Management — Traditionally, the trust departments of wholesale banks had a near monopoly over the management of portfolios, particularly over pension funds. By the early 1970s, however, individual firms and funds began to manage their assets internally. Large corporations, such as Du Pont, General Motors, and General Electric, discovered that they had sufficiently large portfolios to support a sophisticated management group that could manage the pension fund at reduced costs and with high returns. General Electric, for example, employed its in-house bankers to manage their smaller pension funds and managed the design of the computer software it needed for banking. Still, investment banks maintain an expertise advantage in complicated financial transactions. That expertise has enabled them to dominate indexed funds management, which represented the majority of the bank trusts' share of asset management in 1992.⁶¹

Trade Execution — Trade execution has become a direct locus of competition for nonbank wholesale service providers. The principal competition derives from the use of the automated trading systems currently in development or already in use. Using these systems, institutional investors are generating a greater share of the market trade volume, undercutting banks' commission-based revenues that derive from trade brokering and dealing. For example, institutional investors are using electronic trading systems such as Portfolio System for Institutional Trading (POSIT) and the Crossing Network. These two networks accounted for more than 4% of the New York Stock Exchange's trading volume in 1992.⁶² Globex, an electronic trading system of the Chicago Mercantile Exchange, enables around-the-clock trading and eliminates the need for nighttime staffing. As a result, it has led to substantial cost savings for its sponsors and a more efficient market.⁶³ Furthermore, due to the economies of scale of and increasing demand by institutional investors for efficiency in trading, firms that specialize in information and communication technologies — such as Reuters, AT&T, Quotron, and Dow Jones — have gained a foothold in the trade execution.⁶⁴

Custodial Services — Custodial services include administering portfolios and arranging the payment and settlement of trades. Money center and trust banks currently dominate the market because of their payment system privileges, but once again competition is intense. Specifically, as advanced trading and settlement systems become available, wholesale banks must compete for the sizable trading accounts needed to make provision of the services profitable. Firms that specialize in information technologies have a natural advantage today in the technical aspect of trade settlement. Reuters, for example, entered into the custodial services market in 1990, purely on the basis of its experience in automated trading and electronic information services. It is clear that other technology companies will soon follow, as their natural technical advantage in trade settlement becomes apparent.

Bankers Trust's experience indicates the type of strategic technology investment that is required by the elite banks to support long-term innovation in wholesale investor services.

Bankers Trust New York Corp.: Strategic Technology for Portfolio Risk Management and Product Development. Bankers Trust New York provides an excellent example of an investment bank that was able to successfully manage a focused information technology investment.⁶⁵ Bankers Trust is an approximately \$97 billion, wholesale investment bank with limited retail exposure.

From 1987 to 1991, Bankers Trust developed and installed a common systems architecture throughout its organization to lower the cost of ongoing maintenance and enhance systems interoperability. The system has successfully contributed to an advanced risk and portfolio management system (the bank's recent derivative troubles notwithstanding). The common systems architecture has enabled the bank to centralize real-time information in a network and maintain access to that information through shared software. As a result, the bank can process transactions by product type (for example, securities, foreign exchange and options), while simultaneously collecting product positions, local exposures, prices, and rates. The new system also allows the grouping of products into families for cash management or collateral management, depending on the client's wishes. Bankers Trust restructured its transactions to provide its bankers with a complete picture of all sides of, and necessary information on, products that have overlapping functions. For example, when a securities transaction is subsequently hedged, with the currency risk hedged in the foreign exchange market, each portion of the transaction is booked by separate product system *and then reaggregated* at the management control and reporting level.

The benefit of such advanced information networking is that it improves the information flow to the bankers, and cuts costs. External cost comparisons on individual product show that Bankers Trust has an approximate 20% pricing advantage over outside vendors. Such a cost advantage, based on a carefully planned and focused information technology strategy, can be a competitive advantage if it is used effectively to serve clients' needs.⁶⁶

Wholesale Summary

The wholesale banking sector experience exhibits important similarities to that of the retail sector and, of course, real differences. The basic *similarity* between the two sectors is the "unbundling" process. In both the retail and wholesale sectors, advances in information technology and competition have speeded the specialization and narrow targeting of products, services, and markets. On the wholesale side, electronic information networks and trading systems such as the Portal, Crossing Networks, and Spaworks, are reducing transaction costs for tailored origination, placement, and distribution of securities. The significant growth of the commercial paper market provides more evidence of the "unbundling" of wholesale banking into its

constituent parts, each part having become the province of competitive firms — which do not necessarily have to be banks.

An important *difference* between the retail and wholesale sectors is that the wholesale investment banking sector now retains a *privileged position in the field*. As mentioned, the top U.S. investment banks are the world-leaders in their line of business. Furthermore, because of their size and asset base, these banks are also better able to make the increasing information technology investments that are required to remain competitive. Nonetheless, as the examples demonstrate, *even the best* wholesale investment banks are finding that they must adapt in significant ways due to the intensity of the competition. Wholesale bankers are seeing — for the first time — their exclusive customer base threatened by a commodity paradigm. In this respect, it may be that the privileged position of the wholesale banks can be a double-edged sword: if the wholesalers do not see the profound nature of the changes underway, and do not elect to follow the J.P. Morgan example of combining the best of the old with the best of the new, they may meet difficult times ahead by basing their future exclusively on old, loyalty-based client-relationships.

Conclusion

Four general implications regarding the influence of technological innovation on the banking industry follow from the above analysis.

First, securitization is a more efficient way of arranging inputs into outputs and as such is a revolutionary production technology for banks. The combination of modern financial theory, mathematics, and computer processing power have laid the foundation for this new model of finance. When securitization is viewed against the background of the vast and steady improvements in computer processing power, it presents a new banking paradigm. As shown here, securitization has enabled the introduction of highly liquid and flexible financial instruments. Given their popularity with nonbanks financial firms, however, these financial instruments are also working to undercut the traditional banking industry. As shown in the case studies, banks are responding to this development in ways as varied as the nature of the banks themselves. Common to each banks' adjustment, however, is the increased importance that information management and risk analysis expertise have become.

Second, expanding on the first point, the influence of information technology on banking is a double-edged sword. Technological innovation holds the potential for a more efficient industry that provides variety and quality of service, but at the same time it undermines the role of bank branches, requires bankers to have a new skill set, and pressures banks to cede control of segments of their fee structure and delivery pipeline to non-bank financial service providers. Recent events support this view. In October 1994, Microsoft Corp. entered into a \$1.5 billion agreement to purchase Intuit Inc., the popular personal finance software company, though it has

since backed away because of anti-trust concerns. As the *Wall Street Journal* noted, the purchase would have given Microsoft the tools needed to “revolutionize how people do their financial work.”⁶⁷ A survey of banking executives in the same article found that bankers were “worried that software companies may set up financial services that bypass them ... that they could go out to establish banking relationships with the customer.” That is exactly what is happening.

Third, consolidation of the banking industry will continue. The banking sector today includes some 10,600 banks, employs approximately 1.5 million people, and maintains 54,000 branches. Given the present level of technology and competition, it has been predicted that approximately \$10 billion a year in operating costs can be saved through mergers and acquisitions. Some analysts even predict that the industry’s current 100-plus big banks will consolidate into 10 or 15 powerful new banking groups, or multi-service financial enterprises.⁶⁸ A recent survey of bank executives gives added support to that view. Nearly 40% said it was likely that their own banks would be acquired which was double the proportion who thought so in 1993.⁶⁹ Clearly, as has been argued here, there exists a profound mismatch today between the decreasing demand for traditional banking services and the over-supply of banks in the U.S. banking market, generally speaking.

Finally, cultural change is the most subtle consequence of the current banking revolution, and perhaps also the most important. The current process of change in banking is raising some very basic questions, for example: “What is a bank?” and “What is banking?” Not surprisingly, many of the behavioral assumptions that have guided traditional bankers in managing traditional banking enterprises are becoming outmoded, or at least should be questioned. As shown here, the basic principles by which banks organize their employees, develop products, and relate to clients must be rethought. The successful banks have developed a new organizational structure, reward system, and skill set to support new missions. The new model of finance discussed above, based on securitization and risk analysis, will require a reorganization of traditional bank operations. Identifying and pricing risk will require more flexibility, specificity, and creativity in the bank manager’s skill-set, the bank’s organizational structure, and the bank-client relationship.

Combined, these changes may lead to revolutionary changes in the banking industry. The technological innovations described here may also be the first tools paving the way for this new banking paradigm.

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