Chapter 2
Summary . . .

Technology Driven Innovation

Overview

- Technology is allowing innovation to occur in the financial services industry at an accelerating pace, leading to significant changes in financial relationships and market structures.

Key Findings

- Improvements in communications infrastructure and technology are breaking down physical constraints and cost barriers to the transmission, storage and use of information.
- Information networks are evolving in competition with proprietary systems. Pressures for standardisation, interoperability, ease of use and cost effectiveness are increasing. Access to networks is expanding to include a broad range of devices. Improvements in the authentication of users and in the secure transmission of information will accelerate network use.
- Electronic channels for payments and financial services delivery are increasingly taking advantage of networks. Existing delivery channels such as telephone banking and electronic funds transfer are growing rapidly, assisted by technology enhancements.
- Access to information is improving and techniques for collating and interrogating information are becoming more effective and efficient. Consumers are increasingly using these opportunities to avail themselves of new ways to access financial services — physical location of customers and suppliers is becoming less important. Risk

management and customer servicing are becoming more sophisticated.

- Financial industry cost and pricing structures are under challenge. Technology is allowing new entrants to compete by offering specialised services without the need for extensive physical representation. The capital investment required to reap the unit cost advantages of technology is rising in some cases.
- Organised markets and exchanges are facing competition from the availability of information and trading systems that threaten the value of their business. Organisations standing between the customer and the ultimate supplier of financial services must increasingly justify their value in the delivery process.

Technology Driven Innovation

2.1 Introduction

Innovation driven by new technology is a key factor influencing change in many industries, including the financial services industry. The main features of the technologies underpinning these changes are the rapidly declining costs of storing, processing and accessing data through the growth of low-cost communications capacity.

This chapter considers the main characteristics of technology driven innovation in the financial sector.

First, it outlines some of the new technology platforms which are expected to have a major impact on financial services over the next few years.

Secondly, it discusses the likely major areas where innovation will affect financial services. On the basis of trends already evident in Australia and overseas, technology is likely to contribute most to significant future changes in:

- retail payments and financial service distribution channels;
- risk management and data assessment; and
- the conduct of markets and exchanges.

The Inquiry has confined its assessment of technological developments to a broad outline of the likely main changes and has not attempted to predict precisely the pattern or pace of their introduction.

2.2 New Technology Platforms

The likely impact of technology in Australia over coming years depends in part upon the development of a higher capacity infrastructure. With increased capacity, the more sophisticated and user friendly interfacing technology, which is being developed in parallel, is likely to gain more rapid acceptance by users. Together, these developments will accelerate the pace of change.

The main infrastructure developments now under way are those relating to networks, including user software and other associated tools, and the communication systems upon which they rely.

2.2.1 Networks

The emergence of networks and associated information technologies has profoundly changed the information and communications landscape. Networks rely on expanding access and use to ensure continued functionality and cost effectiveness. The expansion and competition of networks give rise to pressures for standardisation, interoperability, ease of use and cost effectiveness. In turn, competitive forces will increase as new entrants gain access and consumers can more readily compare information and perform transactions.

The Internet and private or restricted networks (called 'intranets') have the potential to transform both operations within financial institutions and communications between customers. This transformation is likely to accelerate appreciably upon the imminent resolution of security problems.[1]

Access to networks will not necessarily be confined to personal computers (PCs) or other relatively high-cost devices. Interactive television may be provided through either set-top boxes using existing televisions or Internet-ready televisions. Devices such as public or private access terminals, enhanced automated teller machines (ATMs) and enhanced telephones (both mobile and fixed) may have a greater impact by widening everyday access to

1 For more detailed background on these issues, see McAndrews 1997.

financial services at an affordable price in convenient locations. For example, on one estimate, the use of non-PC devices could reach about 16 per cent of Internet access by the year 2000.[2]

A range of access devices will enable consumers to do their banking, investment and insurance in a variety of locations, depending on the sophistication of the communications capacity required. Attempting to predict the relative importance of particular access technologies is difficult, given that the possibilities will change rapidly as new solutions are developed and because consumer attitudes to new products are not entirely predictable. For example, a recent survey of United States households shows considerable reluctance on the part of consumers to purchase Internet-enabled televisions due to doubts about the interface and their useability.[3] It is worth noting, however, that similar views were expressed about mobile telephones until the broader consumer market became familiar with their advantages.

'Smart cards' with the ability to perform identification and information security functions are expected to facilitate wider access to the Internet over a range of access devices, particularly over relatively basic devices offering data transmission and input capability rather than more powerful PC functionality. Smart card capabilities can be either built into the device (such as in a digital mobile telephone's GSM chip) or accessed via a card reader.

2.2.2 Communications Infrastructure

The rate of development of new networks depends on the installation of low-cost, reliable, high-capacity communications infrastructure. Information networks are expected to dominate Australian communications networks.

Many needs for financial services can be met using the telephone which requires only a relatively simple and largely existing infrastructure. Higher capacity infrastructure is required for delivery of more sophisticated

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2 Jupiter Communications 1997. This includes Internet appliances such as TV set-top boxes, TVs with integrated Internet access and screen telephones.

3 A survey conducted by Dataquest 1996 shows 93 per cent of households polled said they did not plan to purchase an Internet-enabled television or set-top box at any point in time.

products and services to consumers via such means as video signals or high-definition TV. The relationship between product sophistication and required capacity is illustrated in Table 2.1.

More Visual Communication Requires Higher Capacity Technologies . . .

Table 2.1: Indicative Communications Capacity Requirements

Content type	Analogue bandwidth	Uncompressed digital transmission rate	Compressed digital transmission rate	What does this mean?
Voice	4 kHz	telephone grade voice is 64kbit/s	16 kbit/s to 8 kbit/s	Existing telephone infrastructure is adequate
CD-quality audio	about 20 kHz (15 kHz for FM quality)	706 kbit/s mono 1.4 Mbit/s stereo	128 kbit/s per mono channel	With better compression technology, existing telephone infrastructure could cope
PAL TV video signal	5 MHz	159 Mbit/s	1.5 Mbit/s (slow movement) to 6 Mbit/s (fast movement)	Requires upgrade or replacement of existing telephone infrastructure
High-definition TV	possibly up to 30 MHz	over 1000 Mbit/s	20 to 140 Mbit/s	Requires high bandwidth cable or wireless infrastructure

Note: Compression technology is continually improving. The above estimates are indicative of existing technology rather than leading-edge technology. Relative scale: 1,000k = 1M.
Source: Bureau of Transport and Communications Economics 1994, p. 12.

Australia's communications infrastructure is being substantially upgraded via the roll-out of a hybrid optic fibre and coaxial cable network. After July 1997, new entrants to the communications market may introduce additional communications capacity, resulting in increased competition for the provision of services and the introduction of revised pricing structures. Examples of new developments include satellites, other wireless technologies such as microwave, the linking of current private systems with

the public infrastructure to allow spare capacity to be sold and the introduction of new cable capacity from specialist providers and utilities.

Widespread geographic coverage of Australia by higher capacity networks is not expected before early next decade, which is in line with projected broad coverage in many overseas countries.[4] The roll-out of higher capacity infrastructure via an optic fibre network is better suited to higher density population areas but coverage of other areas via high-capacity cable, wireless telephony or improved use of the existing telephone network (using compression technology and upgraded network components as necessary) may be accelerated after July 1997 following the expected entry of new competitors. [5]

2.3 Retail Payments and Distribution Channels

In the retail sector, new lower cost technologies are facilitating significant changes in the use of payments mechanisms and distribution channels for financial services.

For the consumer, these changes potentially make financial services more widely available, at lower cost and with more convenient access. For financial services providers, the new channels present a number of challenges. For example, they can facilitate the entry of new competitors and, at least initially, result in the multiplication of channels with adverse implications for total distribution costs.

The main forms of new distribution channels combine new information processing and communication technologies. In retail banking transaction services a shift to electronic distribution in Australia is expected to occur. A 1996 survey of Australian banks by Ernst & Young indicates that the use of branches for conducting retail banking transactions is projected to decline from 46 per cent of transactions in 1995 to 30 per cent in 1998. Use of

4 Bureau of Transport and Communications Economics 1994, Chapter 7.

5 Estimates by the Bureau of Transport and Communications Economics 1995, Chapter 3, show that 60 per cent of the cost of a hybrid optic fibre coaxial cable network was required to service rural and remote areas, which represent 30 per cent of the total number of households.

electronic channels (ATM, electronic funds transfer at point of sale (EFTPOS), telephone service centres and home banking) is expected to grow to 70 per cent of retail transactions by 1998, with the largest growth expected in telephone service centres.[6]

While projections and measures of the mix of transaction channel usage differ substantially across studies and institutions, evidence reported to the Inquiry in many submissions indicates an unambiguous trend towards greater use of electronic channels for transactions.[7]

2.3.1 ATM and EFTPOS

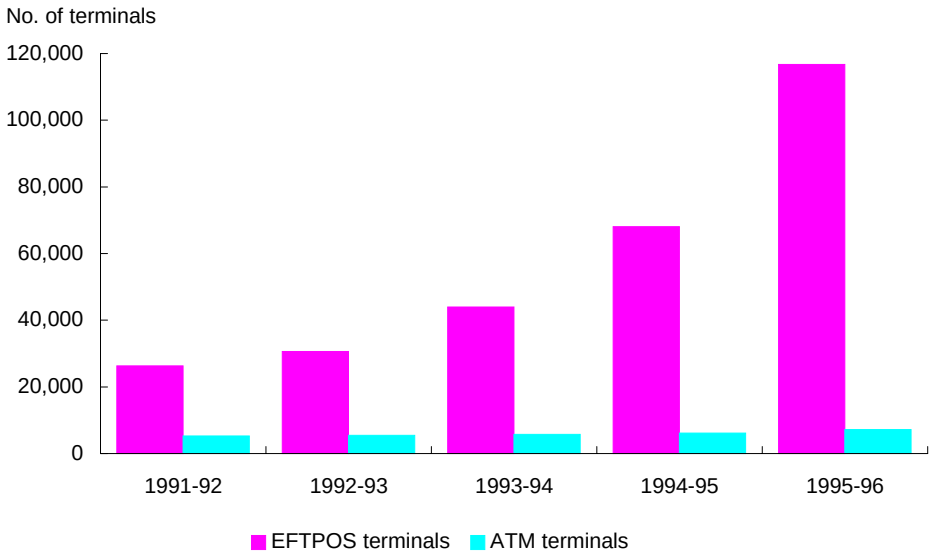
The most visible forms of technology in retail financial services are the ATM and EFTPOS terminal, both of which have gained increased penetration, particularly EFTPOS (see Figure 2.1). Use of ATMs and EFTPOS has led to a large shift towards electronic retail transactions, greatly reducing customer reliance on access to branches and providing the cost savings and convenience of 24-hour service.

6 Ernst & Young 1996. The survey was based on responses by nine banks representing 70 per cent of total Australian banking industry assets.

7 For example, see Submissions to the Inquiry by the Australian Bankers' Association, No. 126 p. 61, the National Australia Bank, No. 131 pp. 2-3 and Bank of Melbourne, No. 218 pp. 16-18.

Rapid Growth in Penetration . . .

Figure 2.1: EFTPOS and ATM Terminals



Source: APSC 1996, *Annual Report 1995/96*, pp. 56 & 58.

2.3.2 Telephone Access

More sophisticated telephone technology, combined with innovations in its use by business through both operator-assisted and interactive voice response systems, is facilitating the increased use of the telephone for accessing a variety of financial services. Such systems also provide greater convenience and lower cost.

FirstDirect, a leading provider of direct telephone banking services, is the fastest growing bank in the UK, with approximately 600,000 customers. FirstDirect is enrolling new customers at the rate of 10,000 per month. It has no branches of its own, but uses Midland Bank branches for deposits and withdrawals. All other customer contact is via the telephone and mail, or via

7,000 ATMs belonging to other banks.[8] FirstDirect is evidence that certain customer groups have accepted telephone banking as a new channel.

Beyond transaction banking, telephone access is increasingly being used by a variety of other service providers, including bank and non-bank mortgage lenders and insurance companies. Direct Line, a telephone-based insurance company in the UK, has three million customers. It holds 12 per cent of the UK private motor insurance market, the largest share ever held by a single company. Direct Line also sells a range of insurance and financial products. The products are standard off-the-shelf services, sold quickly and cheaply via telephone. The computer system calculates underwriting fees, freeing operators to concentrate on customer service and marketing.[9]

2.3.3 Personal Computers and the Internet

Personal Computers

Personal computer banking involves consumers using modem connections and specially tailored software installed on their PCs to undertake banking transactions. At present, relatively young and affluent households are more likely to have PCs and modems, but the extent to which they are being used for home banking purposes is not great. [10] Nonetheless, there is scope for growth in usage, especially as home banking functionality improves. Some 47 per cent of Australian households own PCs and 15 per cent have a modem.[11] Home ownership of PCs may also understate the possible market penetration of this channel. Many workers have access to a computer in the workplace and choose to conduct banking during business hours.

The Internet and Public Networks

Internet communications are growing strongly. Telstra Corporation had originally planned for Internet traffic to overtake telephony and data traffic

8 Information provided to the Inquiry by FirstDirect.
9 The Economist Intelligence Unit and IBM 1996, pp. 44-46.
10 Bank Administration Institute and The Boston Consulting Group 1995.
11 Telstra Multimedia public presentations 1996.

by the year 2000, but has recently revised this to 1998.[12] Internet penetration is large and growing — 11 per cent of the Australian population over 15 years of age is likely to have used the Internet in the past week, and usage is doubling every 10 months.[13] The Internet is currently used primarily as a tool for brand awareness and promotion. While it is possible to conduct financial services transactions over the Internet, its use for this purpose is currently minimal. However, as the Internet becomes more widely accessible and security is improved through technologies such as encryption and authentication, it becomes more likely that households will conduct their financial transactions over the Internet.

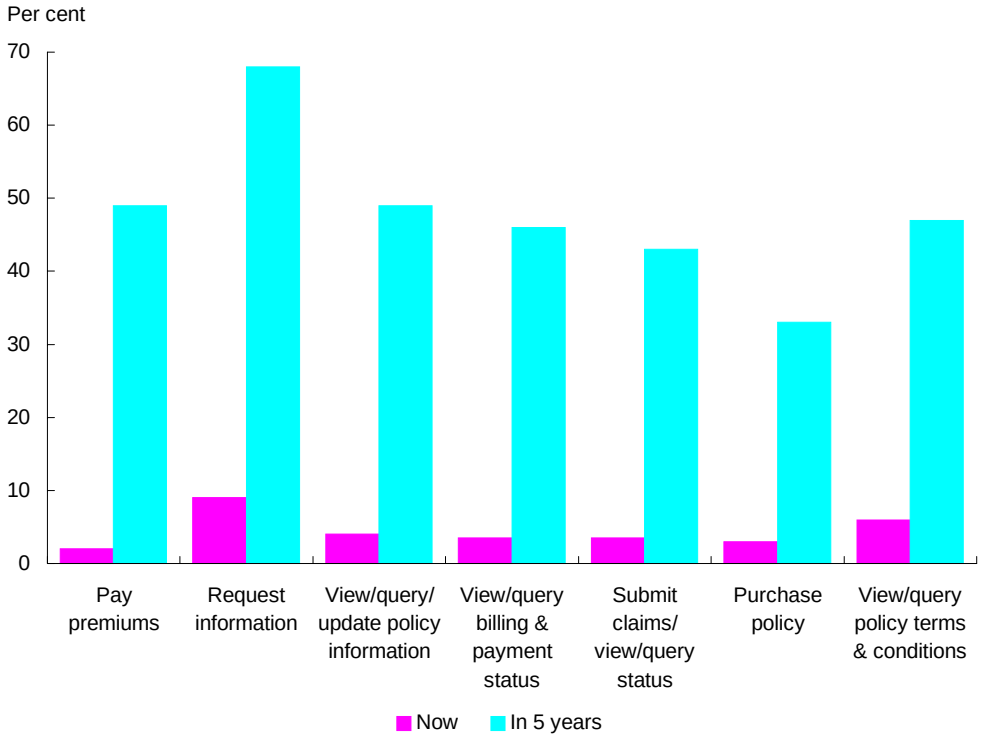
Encryption, if it is sufficiently robust, enables the secure transmission of information over open networks. Authentication of the identity of the sender of information is crucial to the integrity of financial transactions.[14] Advances in technology, such as encryption keys, digital signatures and the use of smart cards as encryption and identification devices, will influence consumer acceptance of networks for more complex and higher value financial transactions.

A joint survey by the Economist Intelligence Unit and IBM in 1996 ascertained the extent to which insurance companies were planning to embrace Internet technology. The survey revealed that a large number of companies planned to offer a wide range of insurance transactions over the Internet, many of which would have previously involved a human interface (see Figure 2.2).

12 Lewis & Head 1997.
13 Telstra Multimedia public presentations 1996.
14 McAndrews 1997.

Use of the Internet by Insurers is Forecast to Grow . . .

Figure 2.2: Insurance Services Planned for the Internet



Source: The Economist Intelligence Unit and IBM 1996, p. 28.

2.3.4 Electronic Cash

At present, most transactions on the Internet are settled via credit card. Several alternative means of payment have been proposed for the Internet, including 'Ecash' and 'CyberCoin', but are yet to be used to any extent. These developments are summarised in Table 2.2. Several of these electronic cash systems are on trial throughout the world, although minimal interest has been shown to date due to their limited usefulness at this time and concerns about their security.

Extensive Trials of Electronic Cash . . .

Table 2.2: Development of Electronic Cash Systems

System	Description	Stage of Development
Credit card	Involves creating an encrypted channel for use of existing cards for Internet purchases.	VISA, MasterCard finalising SET security standard.[15] Trusted third party system providing security of payments.
Electronic cash	Using specially designed software, customer buys electronic cash for digital wallet then sends as payment to merchant. Suited to small value transactions.	DigiCash 'Ecash', and CyberCash 'CyberCoin' are on trial.
Smart card	Several variations, including contactless and swipe cards, disposable and non-disposable, all with varying functionality.	Trials completed in Australia by Transcard, Mastercard, Visa and Quicklink. Various overseas trials including Mondex, VisaCash, Proton and Danmont.

A variety of schemes to ensure the security of Internet transactions have been or are being developed outside the traditional finance sector. Such schemes generally involve a third party providing security for the transmission of payment details separately from the purchasing details of the transaction. Typically:

- customers register preferred payment instruments, such as the details of credit cards, with the trusted party;
- the customer is given a digital identification used to authenticate payments; and
- purchases are made at merchants signed up with the provider to participate in the scheme.[16]

15 The Secure Electronic Transaction (SET) standard has been developed to provide a secure means of payment over the Internet utilising encryption and digital signatures. The authorisation and transmission of payment details is conducted in a secure environment, in parallel with the purchasing process conducted on the Internet.

16 In Australia, Telstra recently announced the introduction of SureLink to provide secure payments over the Internet and through other access points such as kiosks.

The Internet is not the only area in which new payments technology can be applied. Smart cards with a stored value function represent an electronic payment system which can be used as a substitute for cash in everyday retail transactions. Functionality differs substantially between types of cards but, in general, they are able to store and transfer value, record details of transactions and, in some cases, perform a wide range of functions beyond financial services, including storing medical records and identification details.

Smart card trials have been conducted in Australia as well as in many other countries.[17] In Australia, the following trials have been conducted or are in progress:

- **Quicklink** — a reloadable card which has been in operation in Newcastle since 1995;
- **Transcard** — a reloadable card using contactless technology which was designed initially for public transport ticketing — trials have been conducted in Western Sydney since March 1995 and the program is currently being extended in the trial area;
- **Visa Cash** — a disposable and reloadable card launched in November 1995 on the Gold Coast — the card has similar functionality to that used in Atlanta during the Olympic Games; and
- **MasterCard Cash** — a reloadable card which was on trial in Canberra in 1996 (now complete).

Trials have yet to proceed to a full-scale roll-out across Australia.

The use of smart cards for financial transactions is only one possible application. Any application requiring information storage and processing is amenable to smart card use. Of the 3,800 million smart cards projected to be in use worldwide by the year 2000, around 500 million are expected to be stored value cards issued by banks, with the majority being issued as

17 See APSC 1996, *Annual Report 1995/96*, pp. 60-65.

phonecards (1,400 million) and substantial numbers as health cards (400 million) and identification cards (400 million).[18]

Widespread use of smart cards will be enhanced by their mandated use in some countries. For example, it is the stated aim of Singapore to move to a cashless society by the year 2020. Acceptance should also be enhanced by the use of smart cards in non-financial activities such as transport ticketing and identification for security purposes. Ultimately, the primary determinant of the rate of smart card acceptance will be its cost compared with the cost and convenience of cash.

2.3.5 Information and Advice

Another likely role of networks such as the Internet is to allow customers to compare the attributes of competing products and to identify the best product on the basis of specified criteria (price, features etc). Information networks have the ability to commoditise the provision of certain products by exposing differences between suppliers and making arbitrary forms of supplier differentiation difficult to sustain.

Powerful network tools, such as intelligent agents (noted in Chapter 1) which enable consumers easily to identify a product that suits their specific needs, make these networks a potentially important component of future financial relationships. Individuals and businesses can make use of intelligent software which makes searching, obtaining and analysing information more manageable over public and private networks. These intelligent agents could take a variety of forms.

- **Information pull:** intelligent agents that seek and analyse information can be built into various software programs — they are designed to scan data and identify information in accordance with predetermined criteria selected by the user.
- **Information push:** intelligent agents residing on the network can present to the user information which is likely to be of interest — under this approach, the attributes of the user determine the material supplied.

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18 Gemplus Technologies Australasia 1996.

Intelligent agents can perform a variety of functions:

- filter, prioritise and summarise information according to established rules and criteria;
- record information and execute instructions on the user's behalf (either automatically or by prompting appropriate action), evaluate options and recommend action; and
- protect privacy and financial interests and maintain the integrity of data in a useable form.

Consumers will be able to have a more direct relationship with service suppliers through new channels and new style financial services providers. The role of the traditional intermediary providing such services will be challenged by these new providers unless they can justify their value to the customer.

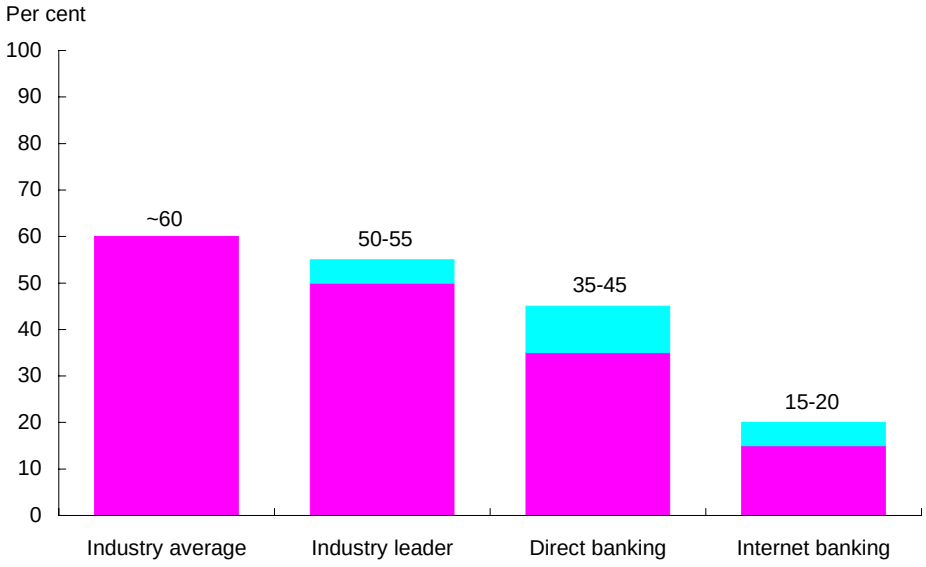
Intelligent agents will not necessarily reside only within PC software. For example, it is possible that most of the processing of information will be performed on a network, so that only relatively small amounts of information need to be transmitted to the user. This will enable the user to process presorted information and to initiate instructions using a less sophisticated device, such as a digital telephone or publicly accessible kiosk.

2.3.6 Implications for Costs and Competition

New technologies such as phone banking and Internet services have the potential to reduce total operating costs (see Figure 2.3). Technology unambiguously lowers unit costs but this is likely to be offset to some extent by an increase in the number of transactions through these new channels as well as the large capital investment required to provide multiple channels. Pricing structures will encourage customers to adopt new, low-cost channels in preference to older, higher cost channels but must also ensure that use of new channels is efficient.

Electronic Banking Potentially Reduces Cost . . .

Figure 2.3: Bank Expense Ratio by Channel[(a)]



(a) Expense ratio is defined as non-interest expense divided by total income (net interest income and no-interest fees).
Source: IBM Consulting Group presentation, sourced from American Bankers' Association and Booz, Allen & Hamilton Internet Banking Survey.

Wholesale markets for financial services are already global. New technologies raise the prospect of international competition for the supply of retail financial services. While selected retail financial services can already be accessed internationally to a limited extent via technologies such as the Internet, there is no evidence to indicate that consumers are using this cross-border capability in any volume at present.

These technologies are introducing a range of new competitors from outside the banking and financial services industry, such as software suppliers and information providers. A 1995 report by the United States Bank Administration Institute and The Boston Consulting Group noted that traditional participants are under threat from players outside the banking

industry that are driving the development of the information superhighway.[19]

2.4 Information and Risk Management

The financial services industry is an information business that can utilise the capability of technology more effectively to manage financial risk and to process and store information more effectively.

Software technology is evolving in line with the capacity of computers to deliver improved processing power. Computer programming technology is improving the way information can be referenced and accessed. The unit cost of performing these tasks is falling although increased capital as well as a greater reliance on more sophisticated systems may be necessary to deliver these cost savings.

The outcome is enhanced decision making capability and greater innovation. Financial products can be developed more quickly, with greater sophistication, and tailored to individual needs. Innovations which often begin at the wholesale level can more quickly flow to retail users. Products, such as capped home loans and leveraged equity investments incorporating put options, are examples of innovations which began in the wholesale markets and are now being applied to retail products.

Risks are more easily identified, allowing the level of risk to be determined more accurately and managed more effectively. However, such tools also facilitate the adoption of large and more concentrated risks and if used inappropriately can have adverse consequences for the inexperienced user. Recent high profile losses associated with derivative instruments illustrate this danger.

New technologies also increase the speed at which information can flow and transactions can be processed. These improvements directly reduce exposures and hence risk.

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19 Bank Administration Institute and The Boston Consulting Group 1995.

2.4.1 Data Mining

Data mining refers to the use of computing power to analyse data to produce information in a more useable form. As technology lowers the cost of processing data, the use of data to improve decision making through techniques such as data mining will increase significantly.

Data can be used to determine the profile of customers most likely to buy a particular product. Marketing programs can be targeted to the needs of particular customer segments and can be more efficient and effective. Consumers can be sent information which is more likely to correspond with the products they would be interested in using, rather than receiving information which is of little relevance to their needs. Marketing programs designed to raise general consumer interest in products can be redesigned to complement better targeted marketing strategies.

In insurance, data analysis (such as analysing the profile of motor vehicle accidents and drivers to assess accident risk or analysing weather patterns to determine possible property losses) improves risk assessment, thereby facilitating greater accuracy in pricing. In other countries, fraud prevention databases are used to reduce the incidence of credit and insurance losses. (In Australia, the requirements of the *Privacy Act 1988* prohibit aspects of this analysis. Privacy issues are discussed in Chapter 11.)

2.4.2 Derivatives

Technology has played a key role in the development of derivative instruments. By allowing risks to be identified and managed independently, a wide range of applications can be developed. Derivatives such as options, swaps, forward and futures contracts use advanced technology to determine pricing and manage exposures.

Global derivatives markets have grown strongly in recent years. As at March 1995, the notional value of contracts outstanding (a measure of market size based on face value) exceeded US$47 trillion, while the gross

market value (the value received or paid to close a position) exceeded US$2.2 trillion.[20]

2.4.3 Credit Assessment

The development of credit risk models to assess the risk of default and determine the appropriate price of credit is a key factor determining the competitiveness of lending. The availability of historical information allows competitors to build default profiles of categories of lending products and customers. Computer technologies have demonstrably increased the capacity, timeliness and reliability of such systems.

Subject to resolving privacy considerations, the application of these techniques could be expanded in such areas as positive credit reporting — which enables better risk assessment and hence lower cost by taking account of all debts owed by a customer, and a profile of the customer's history in meeting such obligations.

The credit assessment process for small business loans is still often subjective and usually requires substantial security (such as a charge over the family home) before credit can be extended. The application of better risk assessment techniques based on improved information gathering and processing is vital for efficiency gains in this sector.

Some lenders in the United States are using proprietary credit scoring systems to assess risk and monitor small business loans nation wide, including in locations where they do not have branches and where the lender's only contact with customers is via mail or telephone. The ability to conduct this type of small business lending is based on the use of extensive industry information.

The potential for efficiency gains based on more fully exploiting information technologies in the areas of positive credit reporting and small and medium enterprise lending are discussed in Chapter 11.

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20 BIS 1996, *Central Bank Survey of Foreign Exchange and Derivative Market Activity 1995*, p.1. Data are for over -the-counter derivative contracts only.

2.4.4 High-Value Payments Systems

Technology enables high-value payments systems to be improved in terms of security and the speed of transmitting payment instructions. The primary goal of payments system operation is to facilitate commerce by providing cost-effective transfer of value. Risk management is one important consideration, as is achieving a low unit cost of processing payments. Technology allows the components of payments risk to be better identified and managed by participants.

Real-time gross settlement (RTGS) systems are generally preferred for ensuring the finality of settlement. Payments in an RTGS system are pre-funded and processed continually throughout the day, rather than netted out for final settlement the following day, thereby assuring participants that payments are irrevocable at the time of receipt. While the system provides greater protection against the consequences of a failure to settle, it places greater reliance on the management of liquidity throughout the day.

Bilateral foreign exchange payment netting services have underpinned foreign exchange settlement for many years. The principal services are provided by FXNET, the Society for Worldwide Interbank Financial Telecommunications (SWIFT) and VALUNET.[21] SWIFT effectively provides the messaging service to allow bilateral settlement to occur. While the volume of messages had increased by over 90 per cent since the start of the decade, the price per message has fallen by more than half (see Figure 2.4).

Multinetting and settlement services have been designed to transform bilaterally arranged foreign exchange transactions into multilateral net settlement obligations and to provide risk controls that ensure the timely settlement of these obligations. The controls are designed to reduce credit and liquidity risks by assuring participants that the final settlement of each currency will take place even if an individual participant is unable to settle its obligations on the due day.[22]

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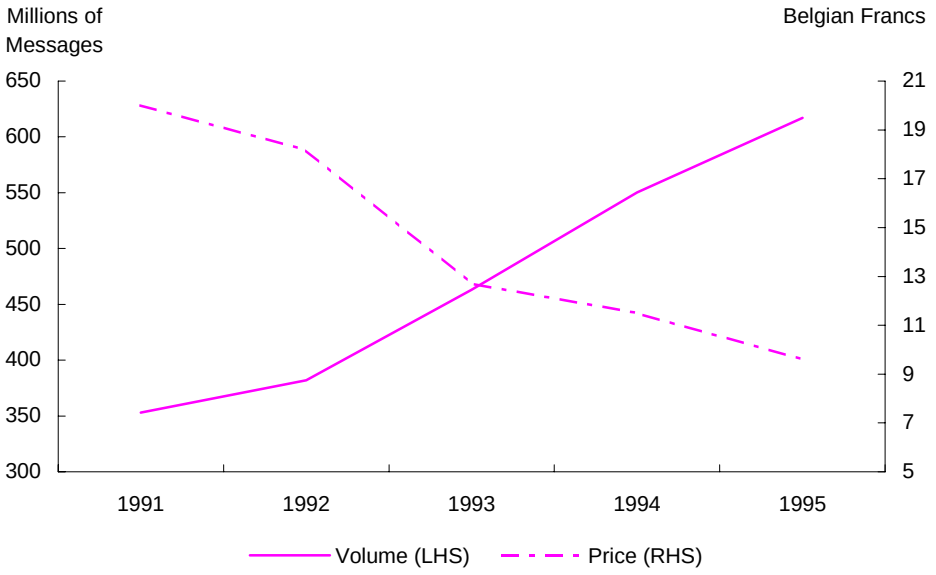
21 For details of the schemes, see BIS 1996, *Settlement Risk in Foreign Exchange Transactions*, p. 15.

22 BIS 1996, *Settlement Risk in Foreign Exchange Transactions*, p. 16.

Volume Up, Price Down . . .

Figure 2.4: Volume and Price of SWIFT Messages



Source: Teitelman and Davis 1996.

2.5 Conduct of Markets and Exchanges

Technology has profoundly influenced the conduct of markets and exchanges. It has resulted in greater efficiency, increased competition among exchanges and over-the-counter (OTC) markets and greater globalisation of trading and investing.

Public announcements are electronically managed in almost all exchanges. However, the level of automation of trading activities varies considerably.[23] In the United States alone, it has been suggested that there are already 100 automated trading systems in operation.[24] In Australia, the Australian Stock Exchange (ASX) began screen trading of equities in 1987 and, since

23 Lee 1996, p. 3.
24 Lee 1996, p. 3.

1990, all shares have been traded electronically. Trading on the ASX derivatives market will also be automated in October 1997.

Ownership of listed Australian shares can now be transferred electronically, without the need for paperwork. Electronic settlement has significantly improved back office productivity and efficiency and reduced the time required to record changes of ownership. A survey conducted in 1996 of users of the ASX's Clearing House Electronic Sub-register System (CHESS) indicated that the system had resulted in an 80 per cent productivity improvement for custodians and institutions, a 19 per cent improvement for brokers and a 50 per cent improvement for issuers and registries.[25]

Similarly, futures trading is affected by technology in several ways. The Sydney Futures Exchange has established trading links with several overseas exchanges and its SYCOM system allows trading to be conducted after on-floor operating hours.

In other countries, computerised markets allow investors to trade directly among themselves without the use of intermediaries. Similarly, netting of trades among institutions is a common practice which means that many changes of share ownership do not take place on registered exchanges.

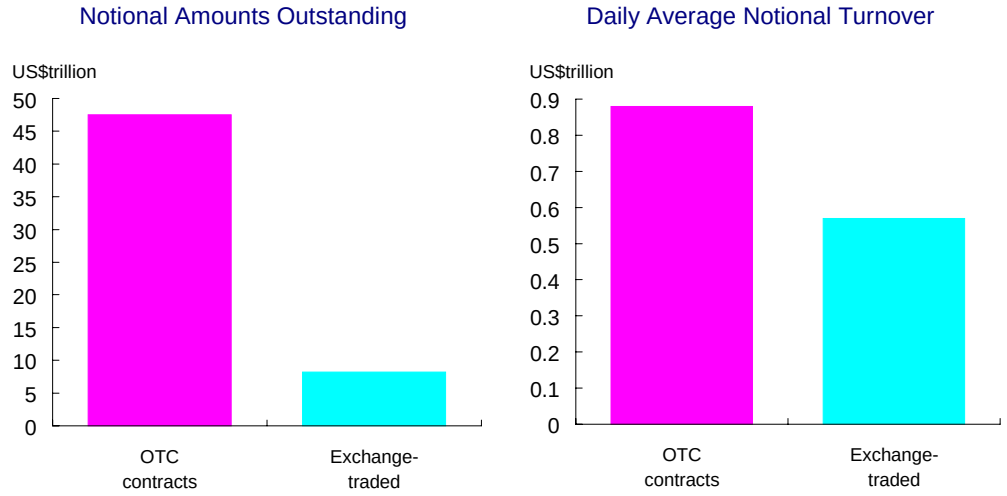
Technology has assisted the growth of the OTC market, which has no designated exchange but involves transactions away from official exchanges. In the foreign exchange markets, for example, global turnover in all instruments exceeds US$1.2 trillion per day — communication between participants is over the telephone and through linked computer systems.[26] OTC trading also represents a large and growing proportion of derivative instruments. Data from the Bank for International Settlements (BIS) shows that OTC markets exceed exchange-traded markets for the value of instruments outstanding and daily turnover (see Figure 2.5). Price feeds between exchanges and OTC participants help to reduce price discrepancies between these markets.

25 PA Consulting Group 1996.

26 BIS 1996, *Central Bank Survey of Foreign Exchange and Derivative Market Activity 1995*, p.3 .

OTC Markets Overshadow Exchange-Traded Markets . . .

Figure 2.5: Global Derivatives Market Activity



Source: BIS 1996, *Central Bank Survey of Foreign Exchange and Derivatives Market Activity 1995.*

Trading in many instruments is now global, reflecting the ability of technology to break dependence on physical location. For example, in the 1980s, one in 14 stock market trades worldwide was either conducted by a foreign counterparty or involved the purchase or sale of a foreign security. By 1996, this had risen to one in four.[27]

Public networks (such as the Internet) may also influence the future structure of markets. Both in Australia and overseas, prospectuses are available on the Internet, reducing the cost of distribution. In the United States, stock offerings can also be made over the Internet to residents of 19 US states. It may ultimately be possible for even small investors to trade directly among themselves without the use of an intermediary.

27 The House of Commons Treasury Committee 1996, p. 3.

2.6 The Future

Technology driven innovation is profoundly reshaping the financial services industry. It is affecting customers, suppliers and intermediaries in a variety of ways.

- The development of networks and improved communications infrastructure is lowering the cost of financial services activities and substantially increasing capabilities and choice. It is introducing a range of new participants, in many cases from outside the financial services industry, and challenging the role of traditional suppliers and intermediaries.
- Retail transactions are rapidly shifting to a wide range of electronic channels, offering greater convenience and lower costs. The development of electronic cash and the evolution of electronic payments systems may substantially change the way in which retail transactions are conducted.
- Technology is facilitating information and risk management activities by delivering a greater ability to use data more effectively for decision making and predictive purposes. It is reshaping the way wholesale activities, such as derivatives trading and high-value payment settlement, are conducted.
- The roles of OTC and exchange markets are being redefined through improvements in information dissemination, trading and settlement activities.

In short, all aspects of the financial services industry are being affected by technological developments.

The Inquiry has not sought to identify likely winners and losers from the forces of technological change but to identify the broad direction of change.