INPUT

RESEARCH REPORT

Impact of Network Computers on Banking

Impact of Network Computers on Banking

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Abstract

Major vendors have been promoting NCs over the past year with vigor and promising bankers an impressive list of benefits, primarily cost-savings, better efficiency and better data security. Overall, bankers are moving cautiously and implementing small-scale NC pilot projects before making any serious commitments. They prefer to avoid technology risk by waiting to adopt the strategy of the industry-wide, winning "camp." At present, 65% of U.S. banks and almost 90% of European banks have either rejected network computers, or are delaying a decision on them.

Reasons for banker resistance to NCs derive, in part, from rapidly falling prices of PCs and network PCs, improved software tools available for network PC systems, and reluctance of IT managers to lose flexibility by committing to any single computer architecture.

At the same time, PC vendors are adopting many of the benefits of NCs to the point where networked PCs may become virtual NCs. On the other hand, vendors of NCs have not achieved the very low prices predicted a year or two ago.

Java programming, which some would argue is at the heart of the NC strategy, is still viewed with suspicion.

From the bank's viewpoint, the lack of resident software and hard-drives on user desktops may well enhance security and control, but possibly at the price of much reduced flexibility.

Significantly, a number of bankers revealed that certain NC pilot projects were implemented and evaluated, but used not as a basis to proceed with a larger NC implementation. Rather, they were used as a basis to abandon the idea altogether.

Overall, bankers remain interested in NCs, but skeptical of their merits.

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IMPACT OF NETWORK COMPUTERS ON BANKING

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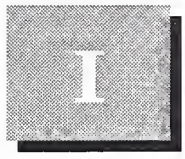


Introduction

A Purpose

The benefits of network computers for enterprise applications such as potential cost-savings, enhanced security and ease of maintenance have attracted widespread interest over the last year. Banks, like other businesses, are trying to decide to what extent they, too, can share in these benefits. Advocates of network computer architectures (primarily vendors) have caught the attention of bankers, but a great deal of uncertainty remains concerning the real advantages and disadvantages of network computers (NC), also called "thin clients," in a bank environment.

This report analyzes banker responses to a wide range of questions regarding network computers, including both banks that have already implemented network computers, or a pilot project for them, and nonuser banks. Among these, some are keeping open the option of switching to NC architecture in the future, others have evaluated and rejected the option for the foreseeable future. Also, survey responses span U.S. and European banks, including their affiliates in each region. The report addresses questions such as:

- What is the scope of current and anticipated NC installations in banks?
- What criteria are banks applying to their decisions concerning whether or not to initiate a NC pilot project?
- Are banks satisfied with vendors and external consultants who advised them on the selection and implementation of their NC projects?
- How satisfied are user banks with their installed NCs?
- What new demands have NCs made on banks' existing IT infrastructure?

B
Scope and Definitions

1. Scope

This report covers network computers in both U.S. and European banking environments. It compares the relative advantages and disadvantages of NCs in comparison with PCs.

In particular, the report analyzes the attitudes of bankers toward NCs in an effort to assess the likelihood that NC penetration of the banking industry will increase significantly over the next few years.

For this reason, the report reflects responses from both NC user and nonuser banks in both regions. In general, bankers express a strong preference for IT solutions that have been widely successful in their industry. For this reason, the experience of the banks that have already adopted NCs has particular importance as an indicator of the future direction of banking industry IT budget activity.

2. Definition of Terms

"Network computers" (or "thin clients") are defined broadly as personal computers that lack internal hard drives, or disk drives for floppy diskettes. They depend on a network server for data, software applications and maintenance as well as for access to the external enterprise and the Internet.

The term is not used to denote what critics have frequently called "stripped-down machines verging on dumb terminals, lacking hard drives or any real processing guts."

Within the limitations indicated by the above definition, network computers can be configured with speeds and capacities comparable to PCs.

C
Research Methodology

This report is based on in-depth telephone interviews with 26 U.S. and 26 European banks. Among them, 9 U.S. banks and 3 European banks had already implemented a network computer installation. Among the nonusers of NC architecture, 17 U.S. banks and 23 European banks were considering NCs for a pilot project in the future.

In addition, secondary research from vendor literature, on-line services and INPUT's proprietary database was used.

D
Report Organization

The report is divided into eight chapters and appendices. The remaining chapters of this report include:

Chapter II, Executive Summary, offers an overview of the analysis completed and summarizes the report's findings. It provides a briefing for a senior executive who wants to understand the most important issues and conclusions without reviewing the entire report.

Chapter III, Acceptance by Banks of Network Computers, examines the extent to which banks have already, or intend to adopt NCs to their operations.

Chapter IV, Analysis of the Network Computer Buying Process, focuses on the selection and evaluation process used by banks for their NC projects. Also, it examines the selection criteria used by banks for vendors to implement and/or support such projects. Finally, it provides banker ratings of product and service vendors used for NC projects.

Chapter V, Do Network Computers Solve Real Problems?, compares the benefits from NCs that bankers expected with the reality of their experience afterward project implementation. In addition, Chapter V compares the expectations of user banks with nonuser banks, along with contrasting discrepancies between U.S. and European evaluations.

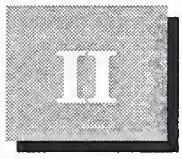
Chapter VI, Conclusion, summarizes the verdict of the evidence provided by banker responses in regard to answering the fundamental questions posed by NC technology:

- Are NCs viable in a banking industry IT environment?
- Do they deliver the cost-savings and/or other benefits as promised by their advocates?

E
Related Reports and Research Bulletins

Related reports and Research Bulletins published by INPUT include:

- *The Impact of Digital Money on Banking*, (December 1997)
- *Evaluation of Digital Money on U.S. Banking*, (December 1997)
- *Evaluation of Digital Money on European Banking,* (January 1997)
- "The Impact of the Microsoft/First Data Payment Service," *Research Bulletin*, (August 1997)
- "Checkbook Troopers Attack Microsoft," *Research Bulletin,* (December 1997)
- *Worldwide Banking, IT Software & Services Markets, 1997 - 2002*, (May 1998)
- *Impact of NCs on the Selection of Internet / Intranet Platforms, U.S.*, "Internet & Intranet Technologies and Solutions" Program, (May 1998)
- *Impact of NCs on the Selection of Internet / Intranet Platforms, Europe,* "Internet & Intranet Technologies and Solutions" Program, (May 1998)



Executive Summary

A
Bank Acceptance of Network Computers

The survey questionnaire for this report polled a select, but varied group of U.S. and European banks on their experiences with, and attitudes toward, network computers (NC) in banking. Based on their responses, 23% of banks reported either having installed network computers, or having a pilot project underway for their anticipated installation.

Major vendors have been promoting NCs over the past year with vigor and promising bankers an impressive list of benefits, primarily cost-savings, better efficiency and better data security. At the same time, bankers are being enlisted in a competitive struggle between the Microsoft / Intel camp that advocates PCs and Windows, and the Sun / Oracle camp that advocates NCs and Java programming alternatives linked to the Internet.

Overall, bankers are moving cautiously and implementing small-scale NC pilot projects before making any serious commitments:

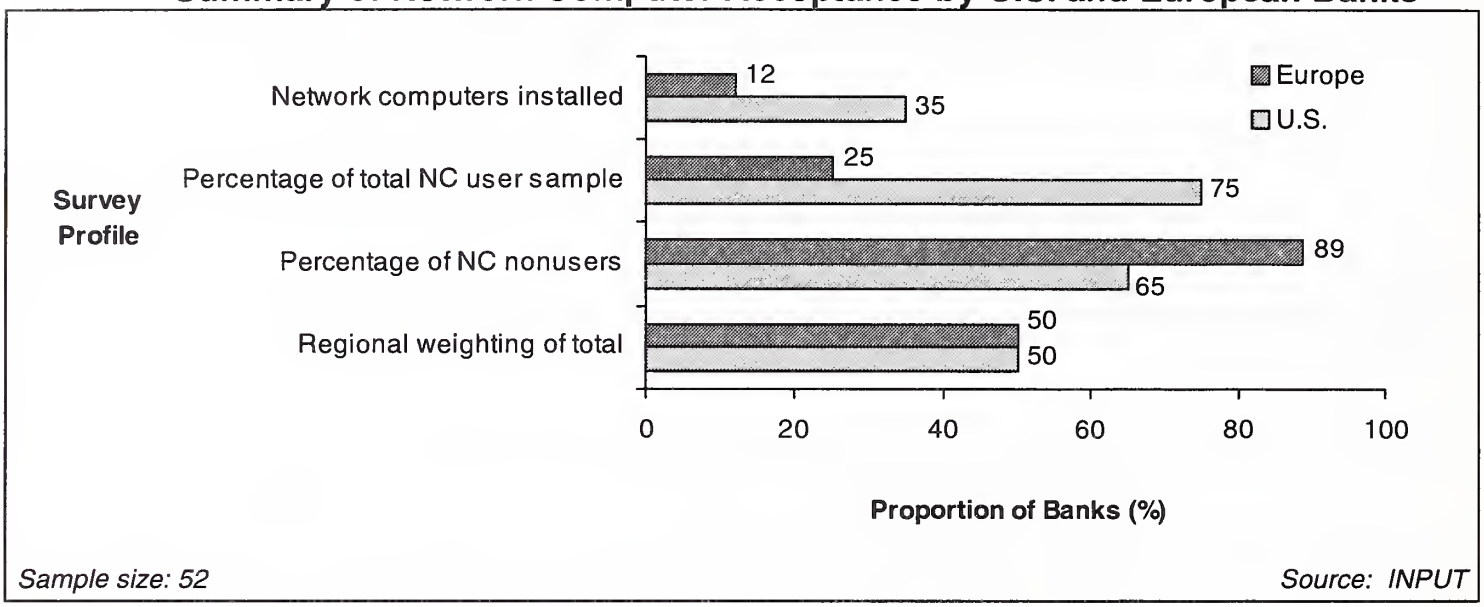
- They prefer avoiding technology risk by waiting to adopt the strategy of the industry-wide, winning "camp."

- They dislike being recruited into vendor IT politics while making what should be a straightforward business decision.

As shown in Exhibit II-1, 35% of the responding U.S. banks and 12% of the European banks in our survey reported having network computers installed.

Exhibit II-1

Summary of Network Computer Acceptance by U.S. and European Banks



Sample size: 52 *Source: INPUT*

However, by extension, 65% of U.S. banks and almost 90% of European banks have either rejected network computers, or are delaying a decision on them.

Three-quarters of the NC user sample reflected in survey results represent U.S. banks, despite the fact—documented in subsequent exhibits—that European bankers appear markedly more sanguine concerning the potential benefits of network computers in banking.

The lower level of expectations of U.S. bankers suggests that future penetration by network computers will be slow among them. Vendors of network computers and related services to banks will likely have more success over the short-term in Europe.

Despite the restricted size and geography of the sample size used for this report, secondary sources of data indicate similar results, both in terms of installment trends and attitudes. A review of data from all sources suggests that:

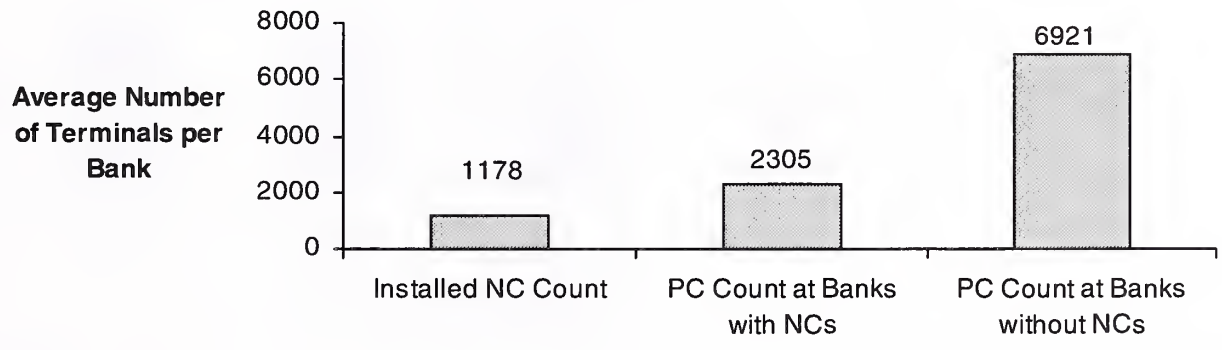
- Companies (and institutions) are adopting network computers more rapidly outside of banking.
- Network computers are being adopted more rapidly (to date) in the U.S. compared with other regions.

- IT systems in banking, as in other industries, will likely evolve to include a mix of PCs and NCs, based on a variety of criteria, and not cost alone.

As shown in Exhibit II-2, current network computer installations on a per bank basis are considerably smaller than comparable PC installations. This suggests that, if bankers achieve the benefits that they expected from their network computer projects, they will likely be expanded and NC architecture will increases its total penetration in the banking industry. There is clearly room to grow, as the average NC installation is less than 1,200 terminals compared with an average of almost 7,000 for PCs.

Exhibit II-2

Average Number of Installed Terminals per Bank



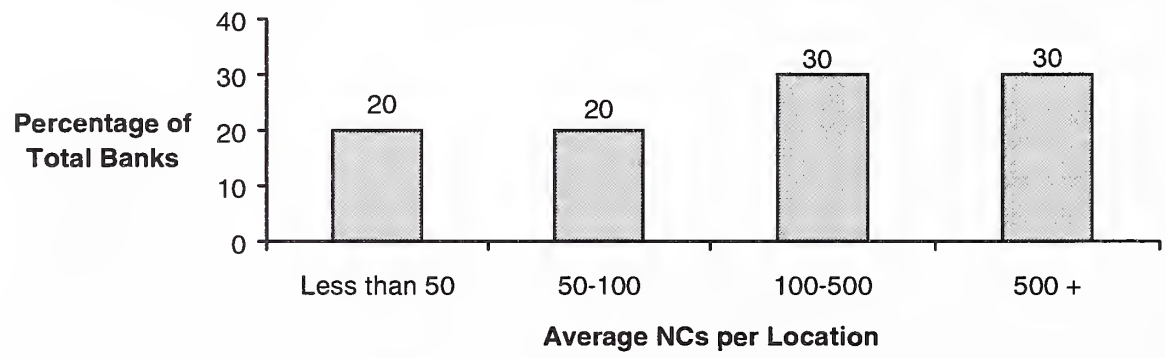
Sample Size: 52 *Source: INPUT*

From another perspective, network computers are being used in configurations that call for comparatively smaller installations per location. Exhibit II-3 shows that 40% of survey banks with NCs have fewer than 100 at each location. Only 30% of such banks have concentrations of more than 500 NCs per location.

However, to some extent these data reflect the headquarters/branch office model used in banking, which differs considerably from the more highly centralized business models used in other industries.

Exhibit II-3

Installed Network Computers per Location



Sample Size: 12 *Source: INPUT*

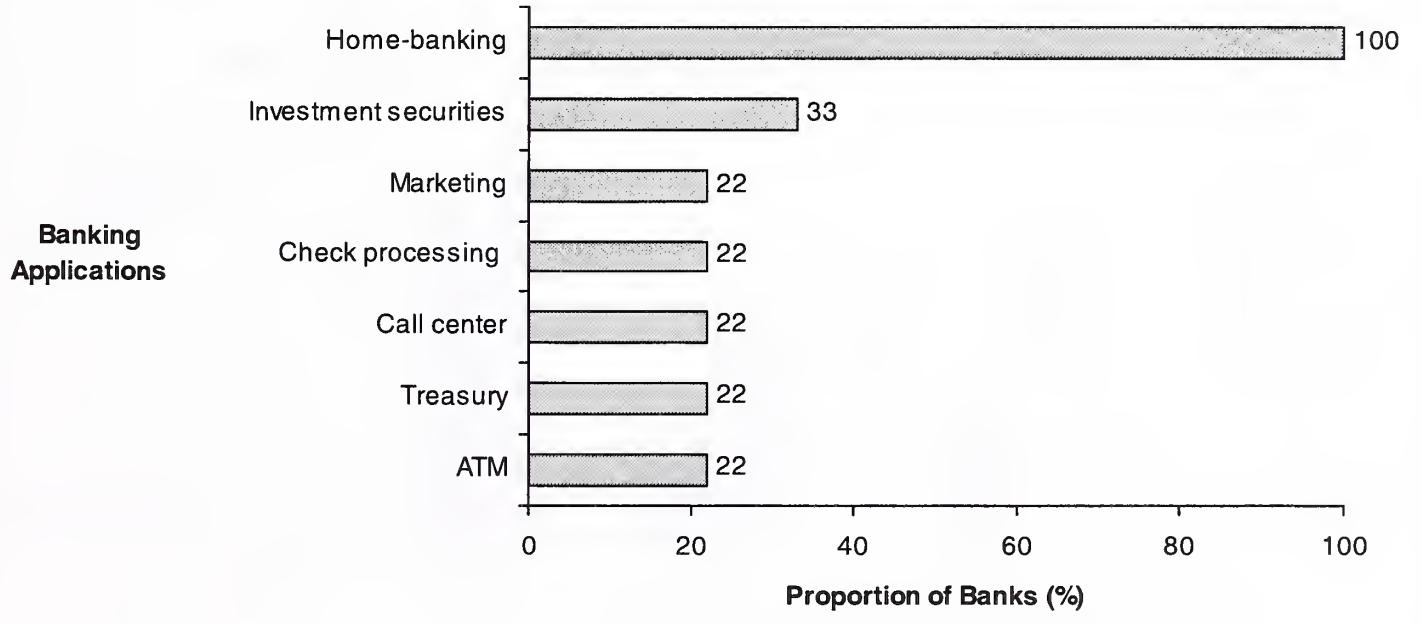
Regarding the mix of banking software applications that are considered particularly appropriate for NCs, survey results permit no definitive conclusions.

As can be seen in Exhibit II-4, with the exception of home banking, bankers did not link NCs strongly to any particular banking application. Similarly, the selection and evaluation process reportedly used by bankers for NCs does not appear skewed toward banking applications as criteria.

Insofar as banks are marketing securities, especially investment funds, through the Internet, the higher rankings awarded these two applications are consistent with data from secondary sources. In general, bankers favor network computers as suitable for routine, repetitive functions.

Exhibit II-4

Banking Applications Currently Run on Network Computers



Sample Size: 12
Rating Scale: Percentages reflect the number of banks that awarded each item a rating of 4 or 5 on a 1-5 scale, 1=totally unimportant, 5=very important

Source: INPUT

B

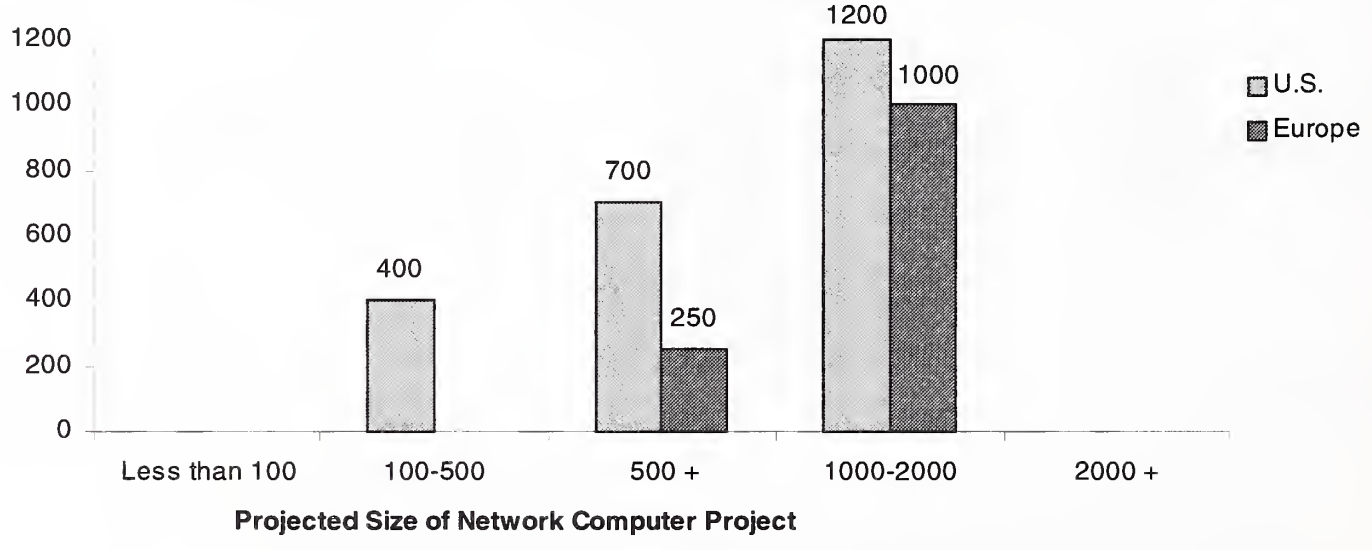
Projected Migration by Banks to Network Computers

During 1998, banks report that they anticipate completing NC installations that span a wide range, from 100-500 units to those with 1,000-2,000 units. Overall, U.S. banks expect the larger installations.

Clearly, the nature of network computers makes them more attractive to large-scale installations with specialized functions. The projected size of NC installations reported reflects this.

Exhibit II-5

Projected Network Computer Installations, Year-end 1998



Sample Size: 52 *Source: INPUT*

Survey results suggest that, in 1999, banks will expand the size of their projected NC installations at the same time that they begin new NC pilot projects of 10 units in order to field test the concept before making any commitments to major expenditures.

This trend will likely continue over the next few years in both the U.S. and Europe until a clear trend emerges within the banking industry as a whole and/or until major banks decide to make large-scale migrations from PCs to NCs.

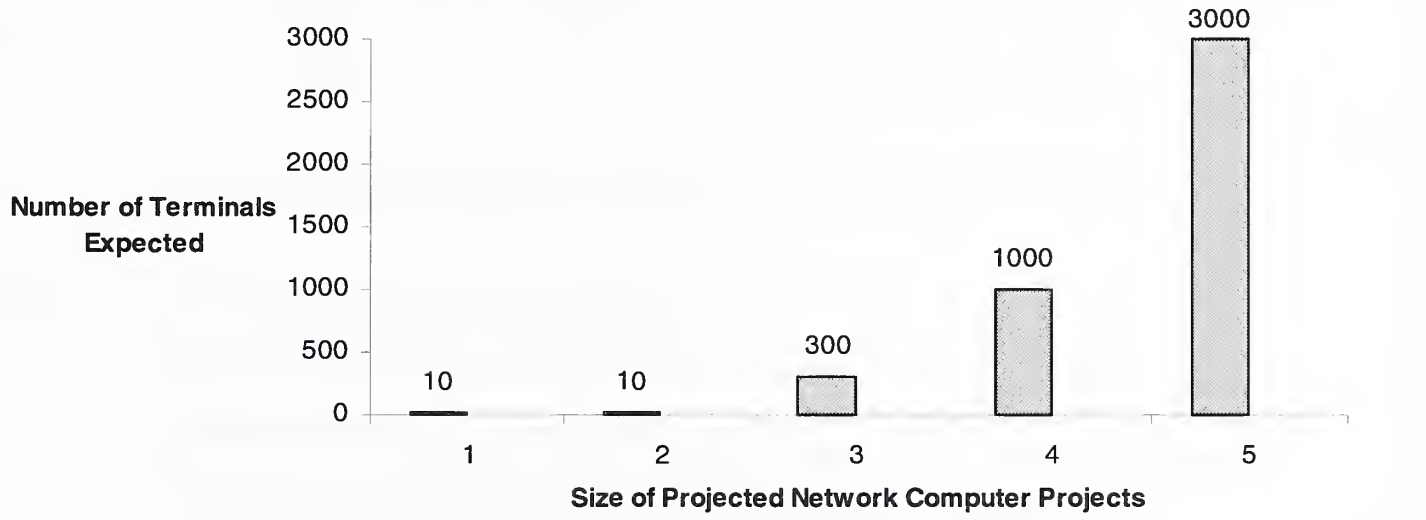
As suggested earlier, more likely will be the evolution of IT systems with room for both NCs and PCs, since bankers do not yet reflect any definitive conclusions about the suitability of NCs to meet their needs.

Alternatively, "fat-client" PCs may become more like "thin-client" NCs over the next few years as PCs come to resemble NC more closely, This will happen as PCs are linked increasingly to NC-like enterprise systems (centralized data/application management, remote system management). Ultimately, the distinction between them may virtually disappear.

Exhibit II-6 reflects the continuation of this lack of consensus among bankers, either in the U.S. or Europe.

Exhibit II-6

Projected Network Computer Installations, Year-end 1999



Sample Size: 52

Source: INPUT

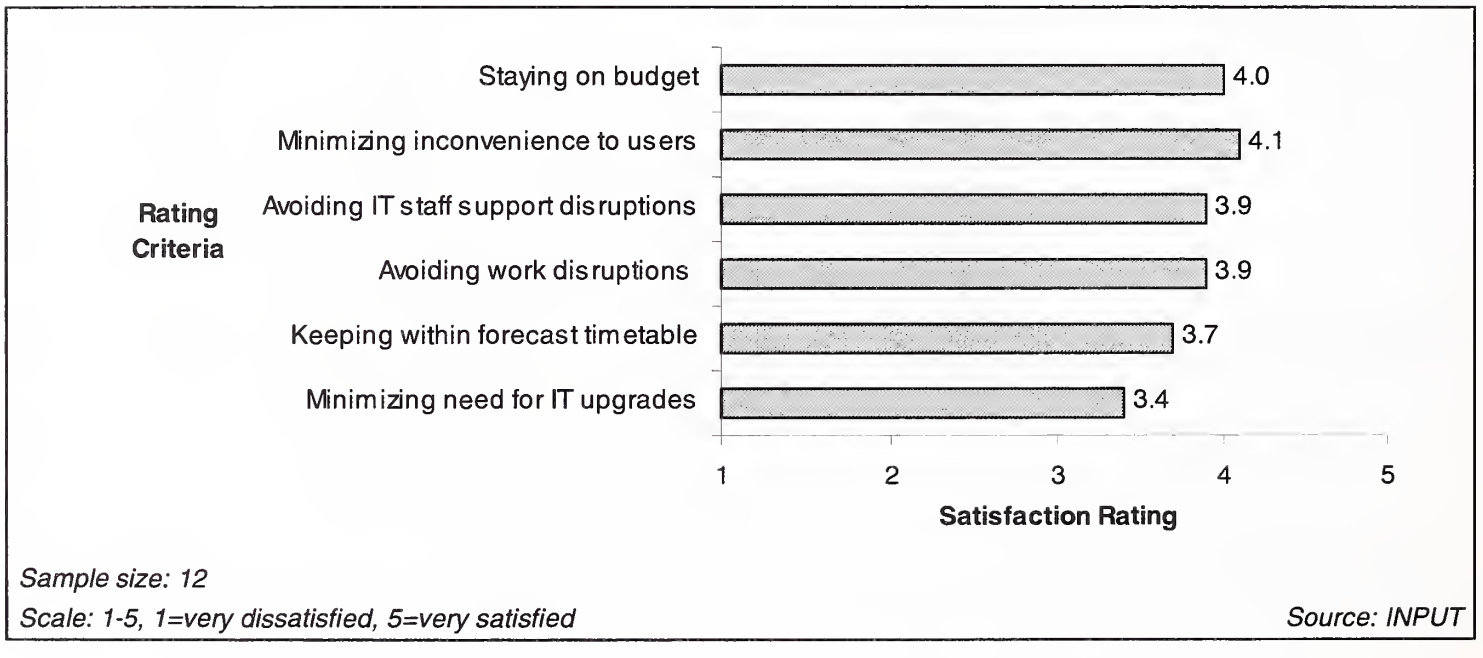
However, this lack of consensus among bankers does not reflect dissatisfaction with their experiences in implementing their NC projects. Exhibit II-7 shows a relatively high level of satisfaction with all phases of the implementation process.

If so, banker reluctance to make new commitments to NCs will result more from findings generated by the selection and evaluation process than from problems generated by realizing those commitments once made.

Survey responses also revealed a higher level of acceptance by European bankers than their U.S. colleagues did for external vendors, or consultants, for services. U.S. banks showed a strong preference for using their internal IT staff resources to implement their NC projects.

Exhibit II-7

User Satisfaction Ratings of Network Computer Implementations



Sample size: 12
Scale: 1-5, 1=very dissatisfied, 5=very satisfied
Source: INPUT

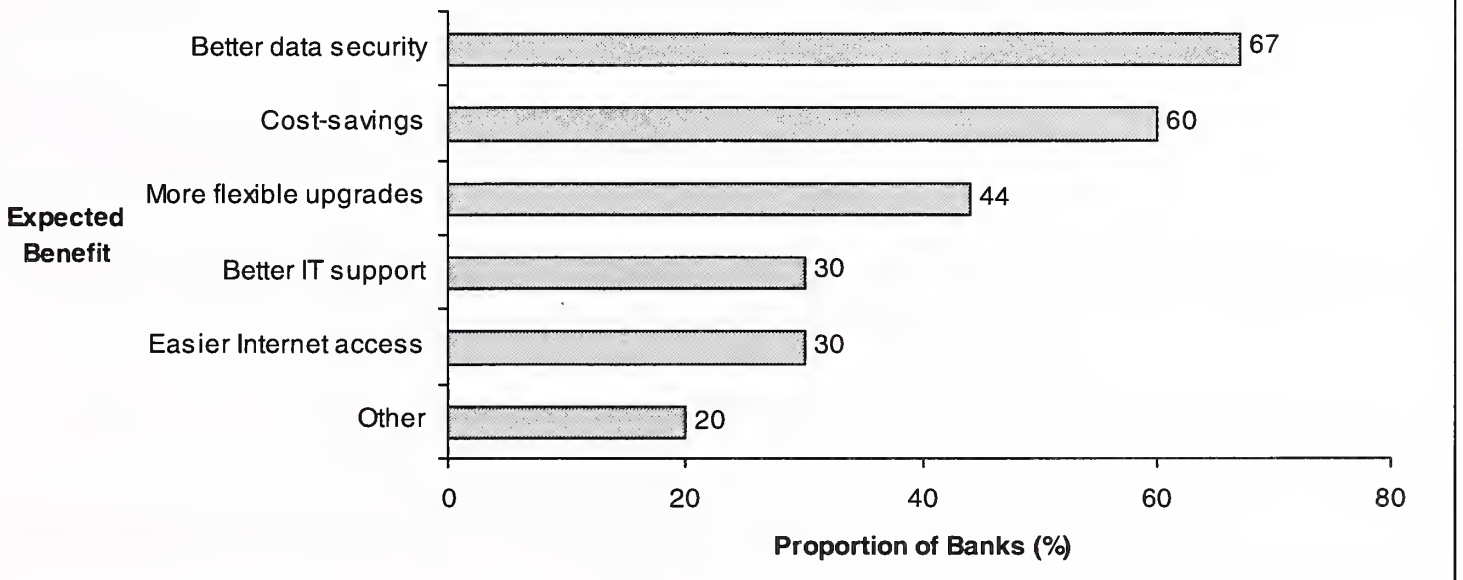
C
Benefits and Expectations

Significantly, banks with NC installations award a higher value on data security than cost-savings as expected benefits than did banks that have no NC installations. As shown in Exhibit II-8, 67% of users gave a rating of 4 or 5 ("important" or "very important" on a 1-5 scale) to data security compared to 60% for cost-savings as an expected benefit.

Also worth noting, Exhibit II-9 shows nonuser banks (those that have no NC installations) as awarding a significantly lower, 2-3 rating to cost-savings as an expected benefit on a 1-5 scale. Vendors of network computers have been promoting cost-savings aggressively as a primary selling point for them. European banks, in particular, give more importance to the benefits of lower demand for IT support and enhanced network security.

Exhibit II-8

Benefits from Network Computers Expected by Users

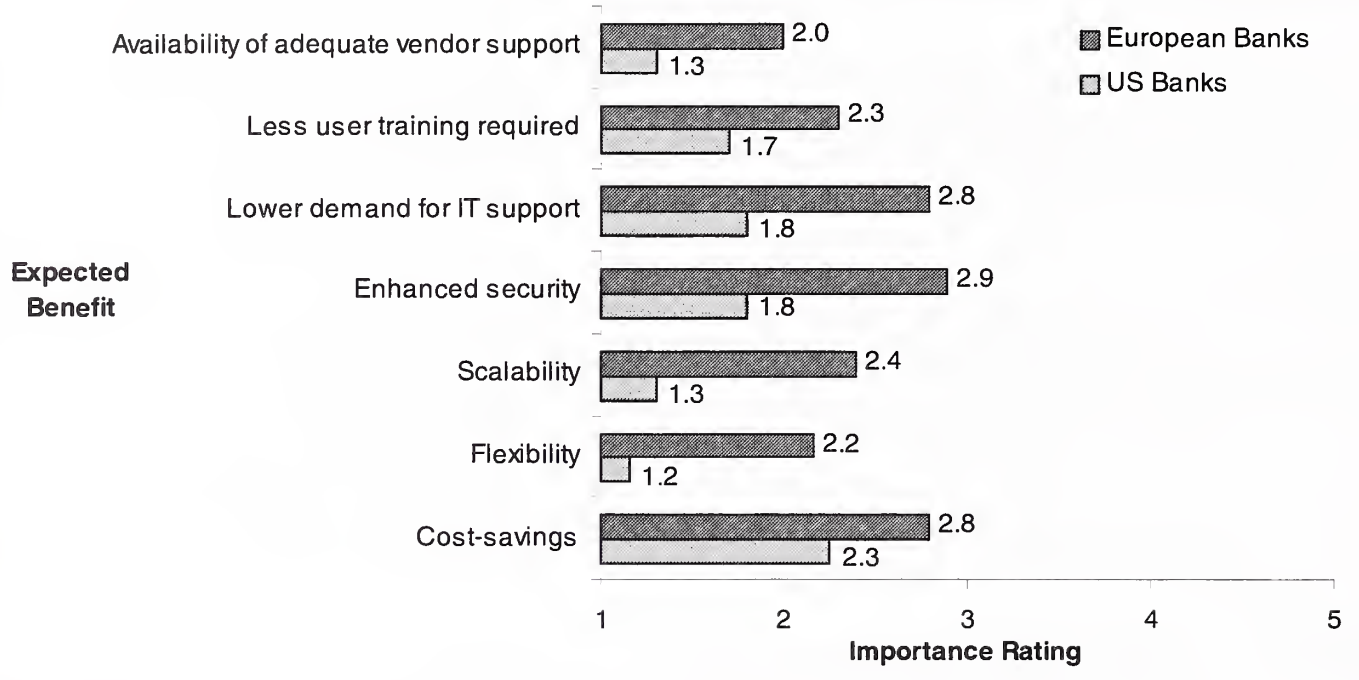


Sample Size: 12
Rating Scale: Percentages reflect the number of banks that awarded each item a rating of 4 or 5 on a 1-5 scale, 1=totally unimportant, 5=very important

Source: INPUT

Exhibit II-9

Benefits Expected from Network Computers by Nonusers



Sample size: 40
Rating Scale: 1-5, 1=totally unimportant, 5=very important
Source: INPUT

Worth noting, Exhibit II-9 shows a divergence between European and U.S. bankers on every point:

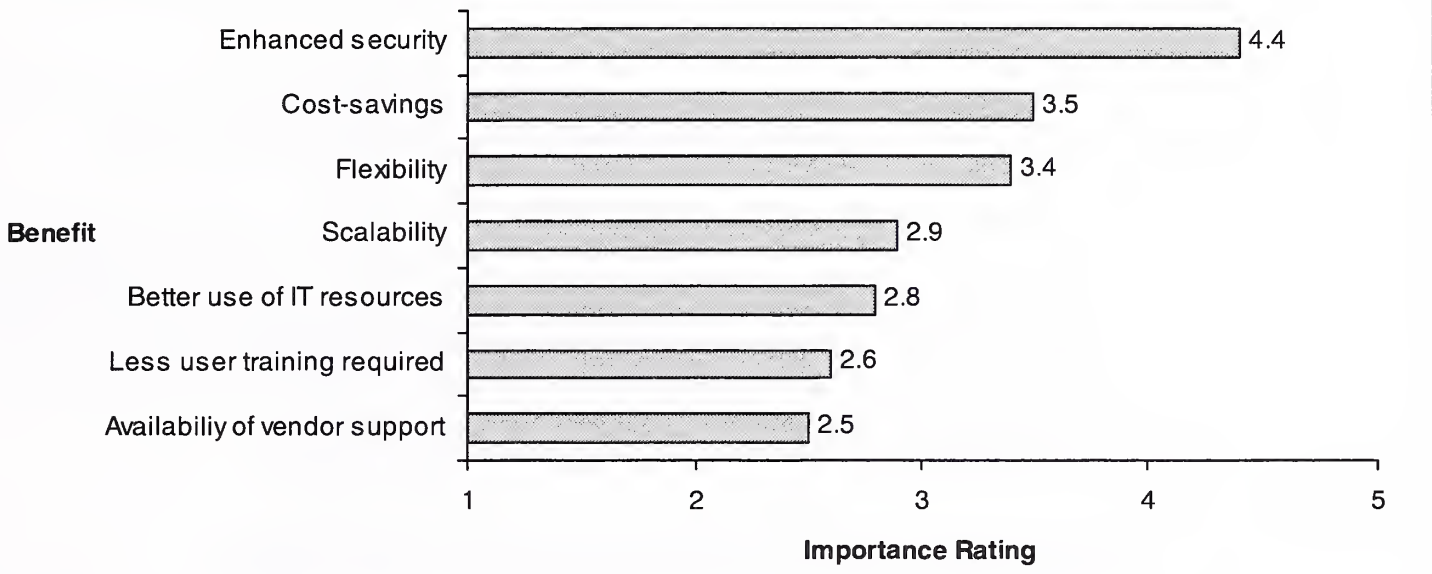
- European bankers rated, without exception, each benefit markedly higher than their American colleagues did.
- This suggests a higher level of skepticism overall among American bankers.
- The importance given to the specific benefits listed was uniformly low.
- They appear to be motivated most strongly by the desire to achieve better network security and more efficient management than by anything else.

In contrast to Exhibit II-8, which reported the number of banks awarding 4 or 5 importance ratings to select, expected benefits from NCs, Exhibit-10 shows bank ratings of benefits achieved, based on their actual experiences with NC installations in a banking environment. Exhibit II-10 shows cost-savings rated lower than "enhanced security" in terms of benefits actually achieved from NCs.

Also, in contrast to the premium given by vendors to the reduced levels of user training required by users of NCs as a selling point, in Exhibit II-10, bankers reported gave this point relatively little importance as a benefit actually achieved.

Exhibit II-10

Rating by Users of Benefits from Network Computers



Sample size: 12

Rating Scale: 1-5, 1=totally unimportant, 5=very important *Source: INPUT*

When nonuser banks were asked to rate a select list of benefits that could serve as potential motivating factors for a future decision to implement a NC project, the results were surprising.

Cost-savings attracted a lower proportion of 4-5 ratings ("Important" and "Very Important") than "better use of IT resources" (i.e., better efficiency) or "PC security problems."

In contrast, banks that had already made a commitment to implement a NC project were motivated by the desire to achieve better data security. After a period of time, they reported having—in fact--achieved better security and cost-savings.

Exhibit II-11 also shows strong differences of opinion between European and American bankers in regard to reasons for their continuing interest in NCs for a future implementation.

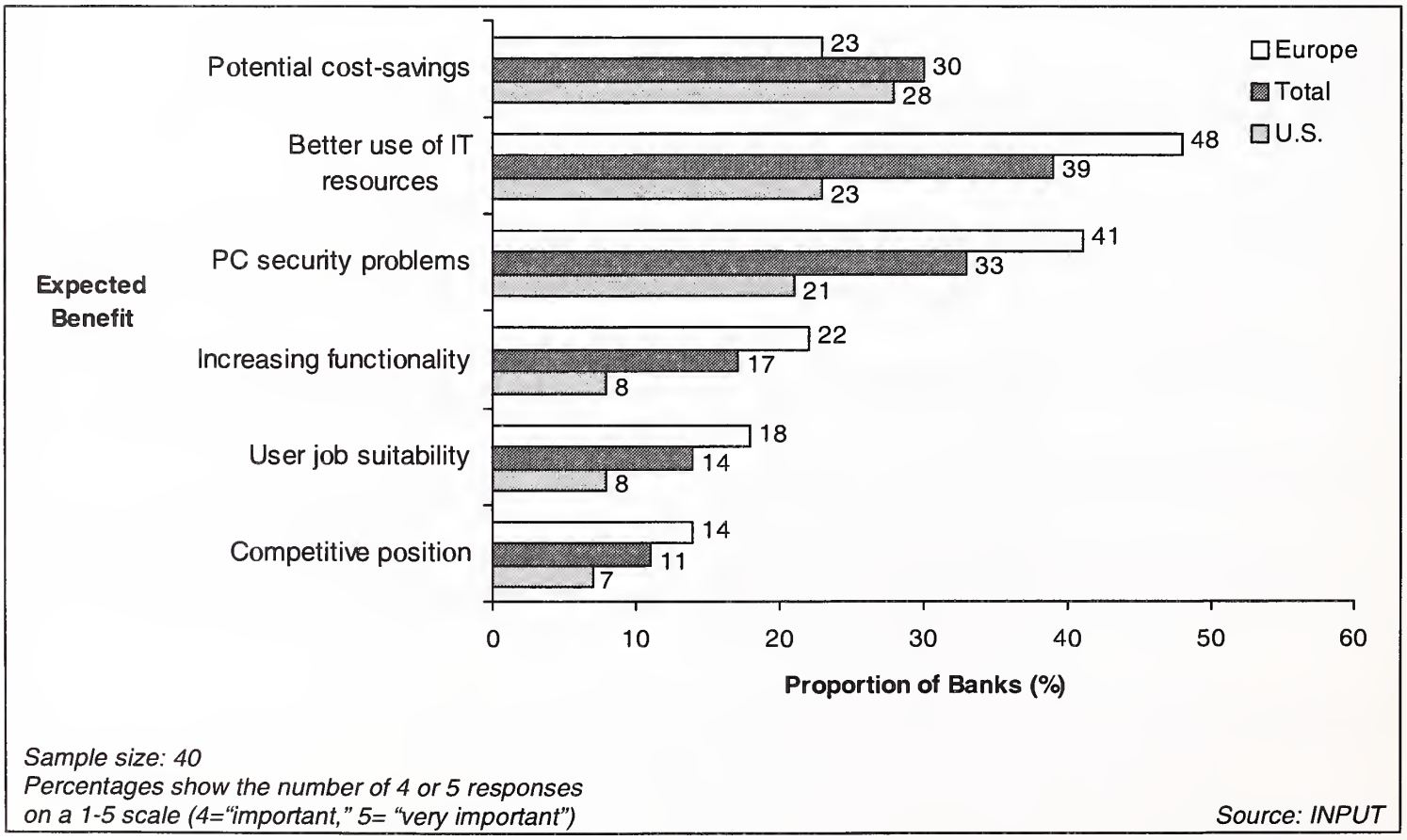
For example, almost double the number of European banks compared with American banks reported interest in network computers in order to make "better use of IT resources." Similarly, double the number of European banks reported interest in "increasing functionality" as a benefit from NCs.

Both European and American bankers expressed roughly the same level of interest in potential cost-savings as a potential benefit of NCs.

These discrepancies signal that there appear to be significant differences between the perceptions of European and American banks in regard to NCs and their suitability to banking. At present, American bankers are less enthusiastic overall than their European colleagues concerning NCs are; accordingly, the benefits that they expect form NCs are uniformly lower.

Exhibit II-11

Reasons for Nonuser Interest in Network Computers



Sample size: 40
Percentages show the number of 4 or 5 responses on a 1-5 scale (4="important," 5= "very important")

Source: INPUT

Despite several attempts to elicit responses from bankers regarding which banking applications they considered particularly suitable, and which unsuitable, for NCs, the effort was largely unsuccessful.
As can be seen in Exhibit II-12, bankers did note a few banking applications that they considered especially suitable for NCs, but there was no consistency among responses. Also, individual comments suggested that there were no strong opinions, or weight of evidence, on the subject.

In general, bankers have the impression that NCs are particularly suitable to workers who use a computer for highly repetitive data entry or data lookup. This suggests that the stigma of NCs as newer versions of "dumb terminals" lingers in their minds and continues to affect their attitude toward them.

Exhibit II-12

Suitability / Unsuitability of Network Computers for Banking Applications

Suitable	Unsuitable
Branch banking	Treasury
E-mail	16-bit DOS applications
Accounting	
Trading room operations	
Help desk	
Customer service	
Loan servicing	
Communications	

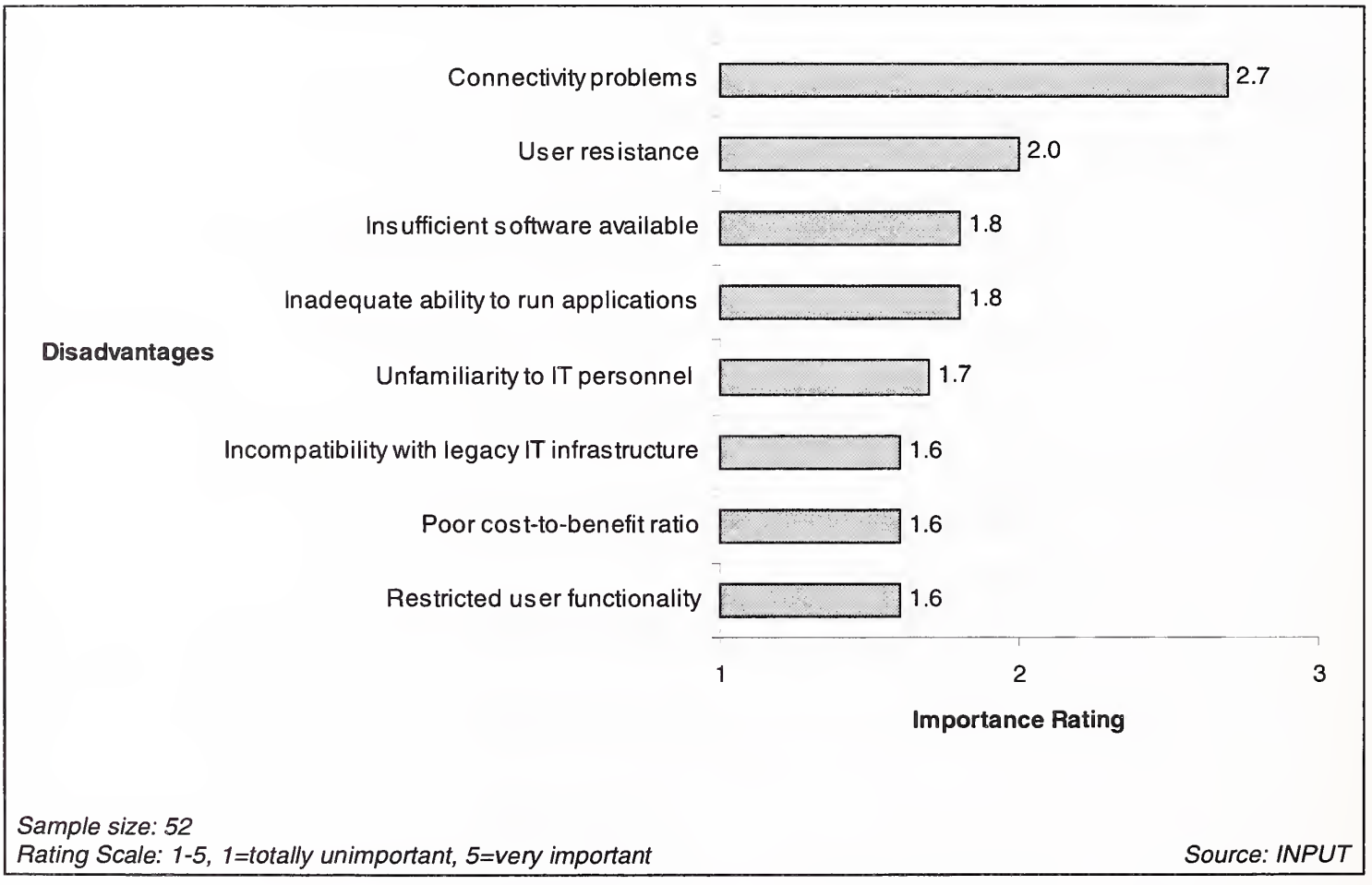
Sample size: 52 *Source: INPUT*

While Exhibit II-13 may give the initial impression that potential disadvantages of NCs loom large in the minds of bankers, in fact, there were no items that merited 4 or 5 level ratings of importance ("important" or "very important").

In fact, all select "disadvantages" noted elicited ratings that reflected low levels of importance. Only "connectivity problems" garnered a rating that indicated a noticeably higher level of importance—but, at less than "3"shows that the issue was not considered out of the ordinary.

Exhibit II-13

Potential Disadvantages of Network Computers



Sample size: 52
Rating Scale: 1-5, 1=totally unimportant, 5=very important

Source: INPUT

D
Conclusions

In view of the fact that nonusers, i.e., banks that have not installed network computers, perceive no markedly important disadvantages of NCs (shown in Exhibit II-13) and the fact that 48% of European banks (39% in total) expressed an interest in NCs due to their potential for making better use of bank IT resources (Exhibit II-11), it would be difficult to avoid the conclusion that banks (especially in Europe) are "waiting to be sold" on NCs.

However, as can be seen in Exhibit II-14, there are substantive categorical, institutional and functional reasons why bankers are either resisting or rejecting NC projects.

While the comments listed are anecdotal and, for that reason, may be dismissed by some as nonauthoritative, they represent an important segment of opinion held by decision-makers at major American and European banks.

In particular, comments such as "They are not yet proven" and "I see no benefit for us" merit attention. They signal that many bankers are not yet convinced that NCs offer either important cost savings, or important advances in network control, security and efficiency, despite vendor emphasis on these selling points.

Reasons for such banker resistance to NCs comes, in part, from:

- Rapidly falling prices of PCs and network PCs.
- Improved software tools available for network PC systems.
- Reluctance of IT managers to lose flexibility by committing to any single computer architecture.

Overall, PCs are adopting many of the benefits of NCs to the point where they may become virtual NCs. On the other hand, vendors of NCs have not achieved the very low prices predicted a year or two ago.

Java programming, which some would argue is at the heart of the NC strategy, is still viewed with suspicion and its disadvantages remain.

Outside of the banking industry, resistance may be even stronger.

For example, when Hewlett-Packard announced a new line of corporate Pentium II PCs with prices starting at $1,260, along with special network

management tools, one HP user responded by saying, "We get the boxes, take the disk drives out, scrub them clean, and put our own software on them. All we're looking for is a cheap iron that doesn't fail." Such users are, in effect, creating their own network computers based on purchase of the least expensive "box" available, in effect, a commodity product.

Bankers, especially in Europe, may be less brutal in their view of computer hardware vendors as strictly commodity sellers, but they are very sensitive to the ability of the PC or NC system to operate sophisticated banking software applications.

On this point, vendors and bankers may be talking at cross-purposes.

For example, when vendors praise the consolidation of software on servers and the ability of IT managers to monitor, update and trouble-shoot applications more efficiently from centralized locations, bankers smell potential disaster. When such centralized servers "crash," they can leave users unable to function independently, even when it may be critically important to do so.

From the bank's viewpoint, the lack of resident software and hard-drives on user desktops may well enhance security and control, but possibly only at the price of much reduced flexibility.

Exhibit II-14

Reasons Why Banks Reject Network Computers

Categorical Reasons	Institutional Reasons	Functional
"They are not yet proven."	"Headquarters operations has not authorized it."	"We can lock down work stations if server goes down."
"Not cost effective"	"We do not have the infrastructure for it."	"Bandwidth a problem."
"There is no use for NC's in banking."	"These decision made at an international level."	"No benefits for us at all and loss of flexibility."
"We are moving from dumb terminals to PCs; the goal is to have all PCs."	"We have just upgraded to PCs and installed a WAN throughout the entire state."	"We have a large variety of applications running on PC's."
"Want to evaluate what big players do first."	"We are planning a full technology evaluation before a pilot is considered."	"We have a large investment in PC's."
"Network computers are totally useless."	"We are not ready for this yet."	"They're not suitable for our software."
"We are not convinced of their usefulness."	"We prefer uniformity within the bank."	"Not practical for us."
"We have no plans for using network computers now or in the future."	"I see no benefit for us."	"We completed a pilot project and decided not to use network computers. We would lose functionality and they would strain the network."
	"They are not suitable for our needs."	
	"We are looking into it."	
	"No interest. They do not fit into our environment."	
	"A pilot project was cancelled due to changes in the market. If the market improves. the project may be revived."	"We examined network computer pilots and found it to be to our advantage to go the PC route for branch and platform automation."
	"We have stable environment that meets our needs."	

Sample size: 40 *Source: INPUT*

Significantly, a number of banker comments included in Exhibit II-14 reveal that certain NC pilot projects were implemented and evaluated, but used not as a basis to proceed with a larger NC implementation. Rather, they were used as a basis to abandon the idea altogether.

Overall, bankers remain interested in NCs, but skeptical of their merits.

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III

Bank Acceptance of Network Computer Architecture

A
Outlook for Network Computers in U.S. and European Banks

1. Politics and IT

For better or worse, the outlook for network computers (NC) in banks appears to depend increasingly on the politics of the Microsoft-Intel battle with Sun-Oracle-Netscape, et al, over Windows versus Java programming and the struggle for open standards. Bankers will not play on the losing team and they favor a negotiated settlement. Meanwhile, NCs are being used as a weapon on the technology front.

Because Java programming is platform-independent, applications written in Java can be used in Windows, or non-Windows environments. To break the link between popular and/or critical, industry-specific software applications and Microsoft Windows, or Windows NT, risks slowing the future advance of the Microsoft juggernaut and the threat is not being taken lightly.

In March 1998, Microsoft and Citrix Systems announced the release of new network software that permits linked PCs to access software applications residing on a server—in effect, offering many of the advantages of NCs. In 1Q 1998, Microsoft released its Windows Terminal Server (WTS), previously called "Hydra," that will work together with Windows NT 4.0 (or Windows NT 5.0 expected within the next 12 months). This will permit companies to recycle obsolete "dumb terminals" using a variation of the Microsoft Windows CE 2.0 operating system and accessing applications from a server.

Citrix released "pICasso", which works in tandem with Windows to deliver applications that reside on the Windows NT server to network terminals that do not operate with Windows—in effect, stealing some of the benefits of Java.

At present, Intel, Dell, NEC and Gateway 2000 (and other) PC vendors have agreed on a list of PC design specifications for the development and marketing of NetPCs that are intended as the PC camp's answer to the NC challenge. These machines use a "sealable" chassis, lacking removable storage drives, and feature extensive remote management capabilities. Meanwhile, IBM stepped up its corporate marketing campaign for a "networked IBM PC" priced at $699.

NCs have been presented to bankers as a low-cost, low-maintenance strategy to accomplish a few key benefits, including reduction of hardware outlays, streamlining of IT support—primarily by regaining centralized control over software.

This includes implementing upgrades efficiently, enhancing network transaction security and dealing with computer viruses quickly.

These benefits result primarily from the key features of NCs, which typically include lack of a hard-drive for desktop data storage, lack of a diskette drive to minimize the risk of introducing viruses (or make unauthorized copies of data).

Overall, NCs eliminate user ability to "customize' desktops with personal screensavers, computer games, special programs or updated copies of curriculum vitae, which also promotes productivity.

2. Network Computers: A "New Technological Paradigm," or a Step Back to the "Dumb Terminals" of Yesterday?

Sun Microsystems and its allies view NCs as the opening wedge of a "family of NC devices, including Internet telephones with electronic mail, smart TVs, personal digital assistants (PDA), game machines, and home-banking applications suitable for digital money transactions. Their vision for the future of NCs, in the mass consumer marketplace as well as in banks, differentiates them far from the "dumb terminals" of yesterday.

Why are network computers the new battlefront?

Because users can (some would say "must") choose between stepping back to Windows NT and a basic client/server configuration where software applications reside on the desktop and the data base on a server, accessed by desktops through a traditional LAN or WAN. Alternatively, users can step forward toward a new paradigm in which applications also reside on the network server.

In contrast, Sun and its allies insist that technological advances (such as the advent of its platform-independent Java programming language) and

the Internet make possible an "Open Standards" computing environment where users need not be limited, either to Microsoft's operating languages, or its software applications.

Also, external servers that deliver Java "applets" (parts of software applications) can be linked to local networks by the Internet.

Java makes it possible for NCs to become what Sun calls "Internet appliances" that access the Internet in order to retrieve application software. Sun and Oracle envision bank desktops at branches and wireless PDAs in the hands of loan officers at client locations accessing centralized applications and databases through Java-assisted programs over the Internet.

Because on-line, home-banking is growing exponentially (a new Government Accounting Office report projects that roughly half of all U.S. banks will offer on-line banking by year-end 1998), home-banking applications have become the "wedge" into banks through NCs.

According to plan, after banks are comfortable with their on-line, home-banking applications, there will be a natural migration from PCs to NCs (and from Microsoft Windows and Windows NT to the Sun / Oracle Java programming solution).

In theory, Internet-based banking will lead naturally and rapidly to bank marketing via web-TV, wireless smart cards and ATM kiosks, to name a few applications.

If so, the outlook for NCs in banks should be seen as one important predictor of a whole series of new developments in IT in banking.

Banking itself becomes only a part of a comprehensive electronic commerce environment where standard payment and security protocols and link customers, vendors, banks and transaction processors.

3. Convergence and Interoperability

Banks, like other businesses, are increasingly attracted to "computer telephony" (called "telematics" and "telematique" in Europe) whereby computer and telephone systems converge.

Banks are already comfortable with their established telephone call centers and telephone-based marketing systems and they are becoming comfortable with their Internet-based home-banking programs.

Therefore, the coming convergence of public-switched telephone networks (PSTN) and Internet Protocol (IP) systems seems only a natural progression. At the same time, their early experiments with e-commerce and digital money have driven home the necessity for an integrated, interoperable enterprise network. In such a system, customers and bankers alike could be linked seamlessly to each other, to banking applications and databases, through telephone, Internet or cable television ("smartTV") networks.

Network computers fit into the equation as low-cost tools. At both the consumer and banker level, they are easy to operate, and platform independent (which makes it possible to incorporate them into the family television).

4. If PC Costs Drop to Commodity Levels, Why Switch to NCs?

During 1997, PC vendors announced a series of ever-lower prices for desktop units, falling first to the $1,300 level, then to below $1,000 (excluding a monitor). Network computer vendors took out the most expensive components and announced NC desktops that were at least 25% below PCs. As of year-end 1997, low-end NCs for business use were being marketed for $650, or less than half of the cost of PCs.

This trend promoted a view that desktops were merely commodities. Indeed, certain vendors, such as Oracle's CEO, Larry Ellison, have announced dramatically that—at $500 per unit—banks and other users should regard network computers as "disposable." In his view, this means that it could be preferable to discard them rather than maintain "an army of engineers" (which is becoming increasingly expensive) to maintain them.

While few bankers at present are ready to accept Ellison's recommendation at face value, they do believe that IT support costs are more important than hardware costs.

B
Banker Attitudes Toward, and Acceptance of Network Computers

1. Ballooning Fixed Costs Drive Search for IT Cost-Savings

Banking IT technology has evolved rapidly from phase one, in which automated teller machines (ATM) permitted customers to access banking databases directly, while repetitive, back-office processes were automated. The second phase of banking automation established client/server networks that linked headquarters to branch offices, and decentralized executives to centralized databases.

Unfortunately, during this same period—while banks' asset base grew dramatically—the banking industry's share of total deposits plummeted over the past 25 years from over half to less than a quarter.

This fund disintermediation process has been more dramatic in the U.S. than in Europe, but the trend holds globally as nonbank financial institutions, such as securities brokers, insurance companies and mutual funds, market financial products with increasing success directly to bank customers.

As a result, noninterest expense at U.S. banks has grown out of proportion to noninterest income—from less than 40% in 1980 to over 50% over recent years. As a result, systems technology expense (as a part of fixed overhead) as a percentage of total expenses at the largest U.S. banks has grown from less than 10% to over 25% of noninterest income.

Banks find themselves doing business increasingly in a higher-risk, lower-margin, more volatile environment where the burden of fixed overhead becomes onerous. Information technology has enabled banks to reduce by 50% costs generated by repetitive processes, such as check processing or credit card processing.

2. Bankers Cool Toward Network Computers

While Exhibit III-1 provides a sense of banker attitudes toward which banking applications they consider to be suitable, and which are considered to be unsuitable for NCs, survey results mainly confirmed preconceptions.

- Bankers, following the consensus opinion, consider NCs mainly suitable for routine, repetitive and individual-user-oriented applications.

- Treasury and other high value-added functions that "power" computing and/or team consultations were generally considered unsuitable for NCs.

To some extent these attitudes reflect experience, but they also paraphrase ideas commonly expressed in the media.

Whatever their bases, opinions expressed by potential bank users of network computers could be more important than those of nonusers because they show the direction of future IT spending. Alternatively, users' opinions may be decisive because they are based on field testing, however limited.

Exhibit III-1

Suitability / Unsuitability of Network Computers for Banking Applications

Suitable	Unsuitable
Branch banking	Treasury
E-mail	16-bit DOS applications
Accounting	Future Intranet
Trading room operations	
Help desk	
Customer service	
Loan servicing	
Communications	

Sample size: 52 *Source: INPUT*

Yet, a review of supplementary data from secondary sources shows no evidence of any particular banking software application that can't be run on NCs, given an efficient network configuration for them.

Exhibit III-2 documents the pilot nature of current bank NC installations. The average size of NC projects is roughly half the size of the installed PC at banks with a mix of the two types and only 14.5% the size of the installed base of PCs at banks without NCs.

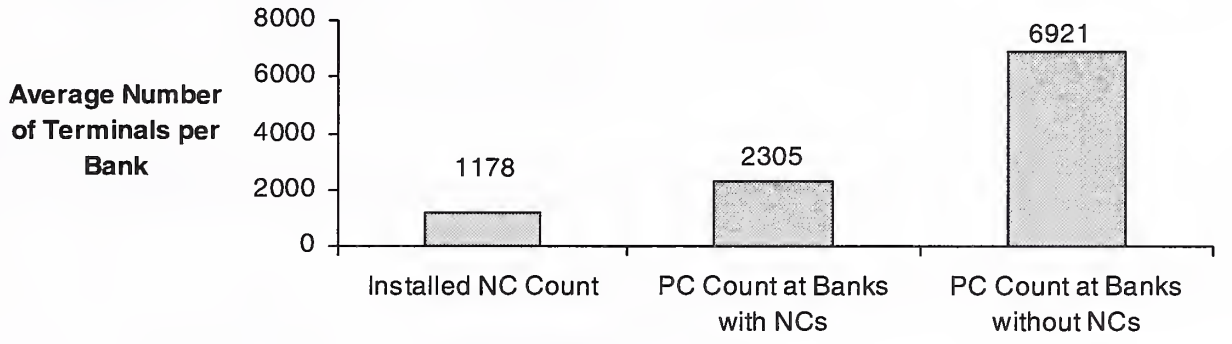
Regardless of the success of these pilot NC projects, no bankers surveyed echoed the predictions of vendor advocates such as Larry Ellison that NCs would, over time, supplant PCs.

Even the banker with the most positive opinions about NCs believe that they are destined, at best, to constitute only a part of a hybrid NC/PC mix in typical banking environments.

They see no necessity to make an "either/or" decision on the matter.

Exhibit III-2

Average Number of Installed Terminals per Bank



Sample Size: 52 *Source: INPUT*

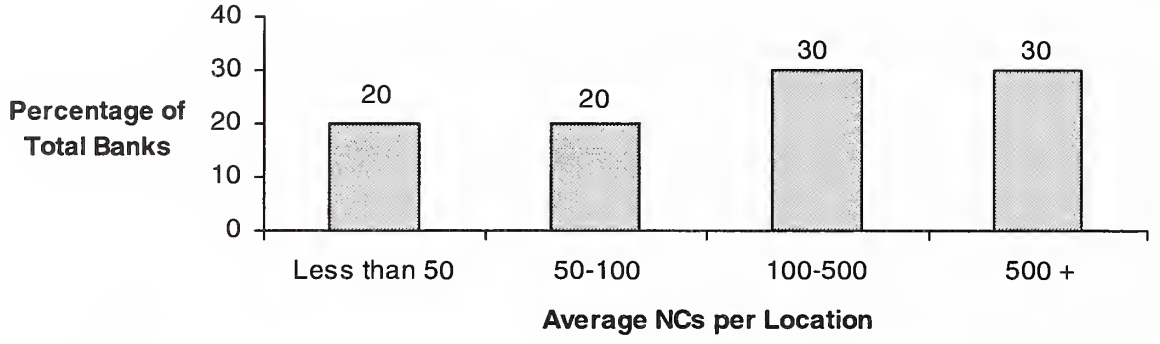
Forty percent of bankers surveyed who had NC installations reported these desktops to be deployed in rather small configurations of either less than 100 users per location, or less than 50. Thirty percent of those surveyed reported configurations that ranged between 100-500.

These data suggest confirm the sense that, to date, bankers are still on the ground floor in regard to their acceptance of NCs. No bank has committed to NC installations in sizes that rival that installed PC bases.

Accordingly, there is no evidence yet of any coming, general migration at banks from PCs to NCs.

Exhibit III-3

Installed Network Computers per Location



Sample Size: 12

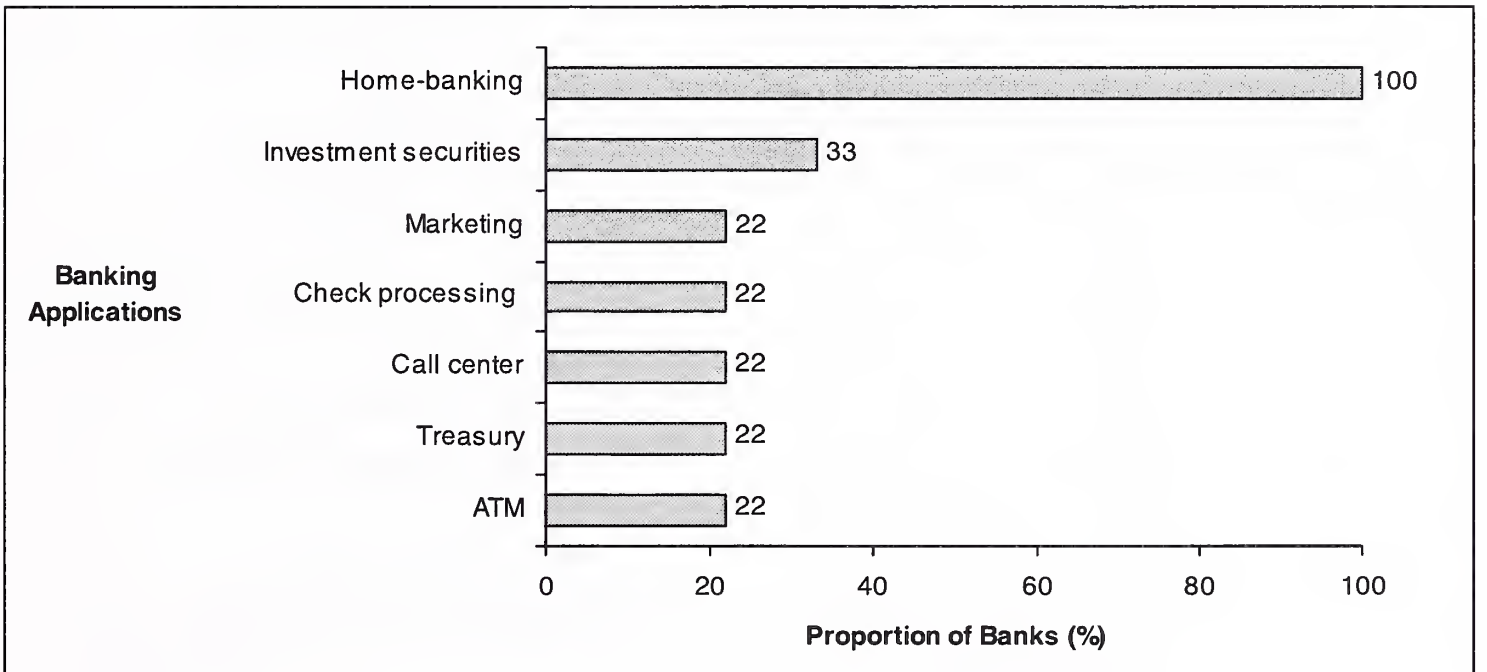
Source: INPUT

Except for the clear preference of bankers to run home-banking applications on NCs, shown in Exhibit III-4, answers concerning other specific banking applications were inconclusive.

All other rating levels were relatively low. Clearly, if bankers decide to implement a NC pilot project, they are not doing so in the belief that NCs are inherently preferable for any particular banking applications. The higher rating for "investment securities" transaction processing is in line with previously expressed banker opinion that NCs may be especially suitable for routine, repetitive back-office functions.

Exhibit III-4

Banking Applications Currently Run on Network Computers



Sample Size: 12
Rating Scale: Percentages reflect the number of banks that awarded each item a rating of 4 or 5 on a 1-5 scale, 1=totally unimportant, 5=very important
Source: INPUT

The survey comments shown in Exhibit III-5 are sketchy and anecdotal, but merit attention nonetheless:

- They document the fundamental view common among bankers that "centralized control" represents one of the most basic advantages of NCs.

- A few comments were contradictory, such as "for applications with low transaction volume" because other bankers insisted that NCs were particularly suitable for **high transaction-volume** applications such as check processing.

- If so, these responses only reinforce an earlier conclusion that bankers were unlikely to decide to adopt NCs on the basis of their preferential suitability to certain banking applications.

Exhibit III-5

Reasons Why Nonusers May Adopt Network Computers

Categorical	Functional
"Reduced cost"	"Simple interactivity"
"Easier maintenance & security"	"Within certain departments, they would be very useful."
"Better security and lower cost"	"Central deployment of software."
	"Improved communications"
	"For applications with low transaction volume."
	"All data is on server simplified support and maintenance."
	"More control of the desk top."
	"Centralized control & less change required."
	"Ease and backup control"
	"The ability to share information"

Sample size: 40 *Source: INPUT*

More important, Exhibit III-6 captures survey responses that indicate reasons why bankers are **unlikely** to adopt NCs in great numbers in the foreseeable future.

The first comment, "They are not yet proven," crystallizes an enduring characteristic of bankers.

In general, they tend to be risk-averse with a strong preference toward consensus decisions. Only when they believe that the banking industry as a whole has decided an issue do they feel comfortable in taking action:

- There are few pioneers among them and these tend to be found among the largest money-center banks with the deepest pockets.

- This view was expressed clearly in the comment "Want to evaluate what big players do first."

The majority of bankers will not adopt NCs until they have a good number of positive examples among their larger peers.

Beyond the objective obstacles, such as insufficient bandwidth or budget, most comments highlighted in Exhibit III-5 express a deep skepticism about, and lack of confidence in NCs to provide bankers with any important benefits.

Some bankers were cautious, saying, "We're looking into it," while others rejected NCs flatly, saying, "We are not convinced of their usefulness." At least one banker revealed that a NC pilot project had been cancelled and plans to go forward with NCs had been postponed indefinitely.

Overall, these responses reveal a surprisingly large reservoir of skepticism among bankers regarding NCs. If so, the outlook for their large-scale adoption in banking does not appear likely in the short term, if at all.

Exhibit III-6

Reasons Why Banks Reject Network Computers

Categorical Reasons	Institutional Reasons	Functional
"They are not yet proven."	"Headquarters operations has not authorized it."	"We can lock down work stations if server goes down."
"Not cost effective"	"We do not have the infrastructure for it."	"Bandwidth a problem."
"There is no use for NC's in banking."	"These decision made at an international level."	"No benefits for us at all and loss of flexibility."
"We are moving from dumb terminals to PCs; the goal is to have all PCs."	"We have just upgraded to PCs and installed a WAN throughout the entire state."	"We have a large variety of applications running on PC's."
"Want to evaluate what big players do first."	"We are planning a full technology evaluation before a pilot is considered."	"We have a large investment in PC's."
"Network computers are totally useless."	"We are not ready for this yet."	"They're not suitable for our software."
"We are not convinced of their usefulness."	"We prefer uniformity within the bank."	"Not practical for us."
"We have no plans for using network computers now or in the future."	"I see no benefit for us."	"We completed a pilot project and decided not to use network computers. We would lose functionality and they would strain the network."
	"They are not suitable for our needs."	
	"We are looking into it."	
	"No interest they do not fit into our environment."	
	"A pilot project was cancelled due to changes in the market. If the market improves. the project may be revived."	"We examined network computer pilots and found it to be to our advantage to go the PC route for branch and platform automation."
	"We have stable environment that meets our needs."	

Sample size: 40 *Source: INPUT*

The survey responses reflected in Exhibit III-6 reiterate similar questions concerning the suitability or unsuitability of select banking applications for NCs.

As before, home banking and investment security processing were rated as highly suitable to NCs. However, in this case "marketing," "call center processing" and "Treasury" functions also ranked equally high.

These results reveal that:

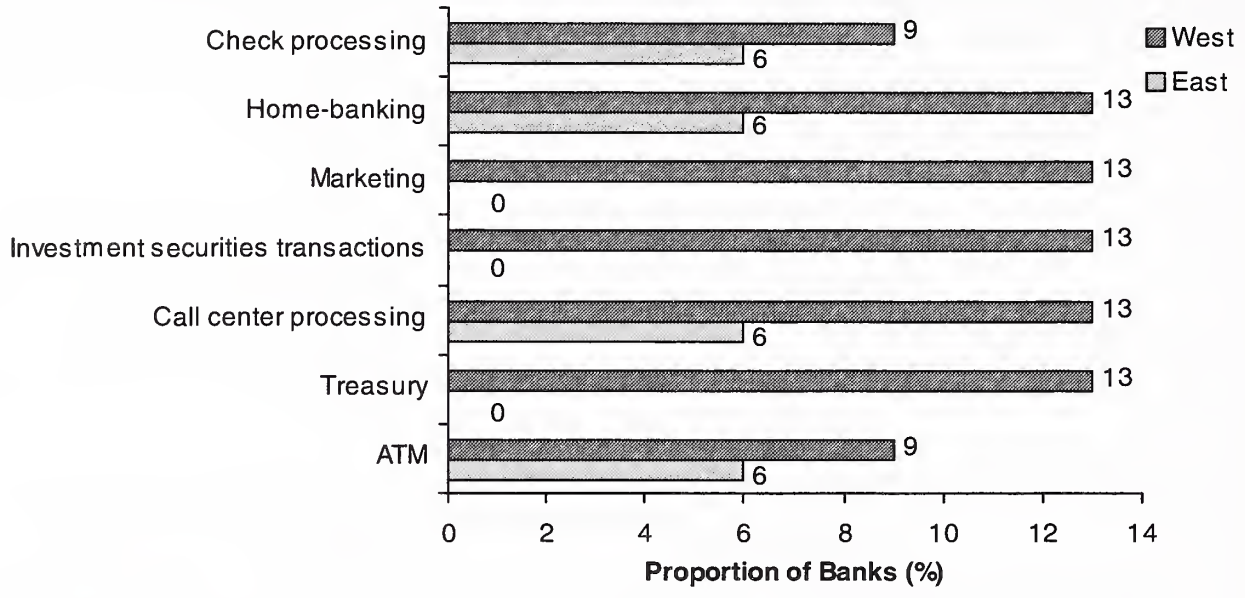
- Bankers are, in fact, quite unclear concerning the questions of which banking applications are especially suitable for NCs.
- It remains unclear whether or not NCs are more suitable than PCs for high transaction-processing volume work.
- Opinions of American and European bankers differed widely concerning the suitability of NCs for particular banking applications.

Significantly, Exhibit III-7 portrays responses of **nonusers.** Their views on the topic of suitability were not tested by field experience, but they are important because they form part of the basis on which bankers will decide whether or not to commit to future NC pilot projects.

Among this group, European bankers appear much more positive than their American counterparts concerning the likelihood that NCs will be advantageous in these banking applications.

Exhibit III-7

Projected Banking Applications for Network Computers by Nonusers



Sample size: 40

Percentages show the number of responses at the level 4 or 5 on a 1-5 scale (4=important, 5= very important)

Source: INPUT

Similar to the results shown in Exhibit III-1, survey responses given in Exhibit III-8 reinforce the apparent consensus among banks without NCs that network computers are mainly suitable for "low-end" users rather than for "power users" who use "sophisticated applications."

In the minds of nonuser bankers, NCs are seen as newer versions of yesterday's "dumb terminals."

Vendors have not yet succeeded in differentiating these products or ridding them of a residual stigma. For that reason, many bankers continue to perceive a bid to adopt NCs as a "step backward."

Exhibit III-8

Banking Applications Most Suitable for Network Computers, According to Nonusers

Banking Applications
"Remote users"
"Word processing"
"On-line banking"
"Home-banking"
"Cash management"
"Call centers"
"For proprietary systems in bank suitable for terminal emulation screens"
"Treasury areas"
"Retail banking"
"Internet solutions"
"Simple unsophisticated applications"
"Suitable for low-end users, not for power users"
"Branch banking"
"Customer applications"
"Branch use"
"When using mainframe applications"
"Great for internal corporate functions and operations, i.e. accounting"

Sample size: 40 *Source: INPUT*

Exhibit III-9 illustrates the extent of the confusion in the minds of bankers regarding the real advantages and disadvantages of NCs for banking applications.

When comparing these responses to those given earlier, a number of inconsistencies and contradictions appear.

For example, previous responses reflected a belief that NCs were particularly suitable for marketing and Treasury functions. Here, they are considered **unsuitable**. Again, the comment "desktop applications" expresses a fundamental, but erroneous view that individual user files are unavailable to NC users because they lack resident hard drives.

Similarly, the comment "areas that need flexibility and software" express an erroneous belief that software applications cannot be available to users unless they are resident in an individual desktop hard drive.

Exhibit III-9

Banking Applications Least Suitable for Network Computers, According to Nonusers

Banking Application
"Those high in graphics or spreadsheets"
"Marketing"
"Corporate affairs and HR"
"Program development"
"Desktop applications"
"Workstation processing & spreadsheets"
"Accounting systems"
"All of our applications"
"Complicated applications, such as Treasury"
"Areas that need flexibility and software"
"Sophisticated applications"
"Marketing and accounting, which need flexibility"
"Anything that requires data analysis"
"Number crunching"
"Not practical for us; all of our applications are used by different departments, using different servers with no central applications"
"For any banking application"
"At the branch office level"
"Can not think of one"

Source: INPUT

C
Projects Underway

NC installations at the 23% of American and European banks surveyed are analyzed in Chapter V, section F. Virtually all of these banks consider their current NC installations to be project laboratories that will yield results to be used for a future decision concerning whether or not to expand the bank's NC network.

The media have published numerous predictions that, by 2005, NCs will be outselling PCs by ten to one. If so, bankers will likely remain in the minority of NC users, as INPUT survey results reveal no groundswell of enthusiasm for them among bankers.

On the contrary, as indicated earlier, skepticism and misconceptions abound. These negative perceptions concerning NCs will likely delay bankers' already limited attraction to them, which is based primarily on the promise of cost-savings rather than functionality.

D
Outlook for a PC-to-NC Migration at Banks

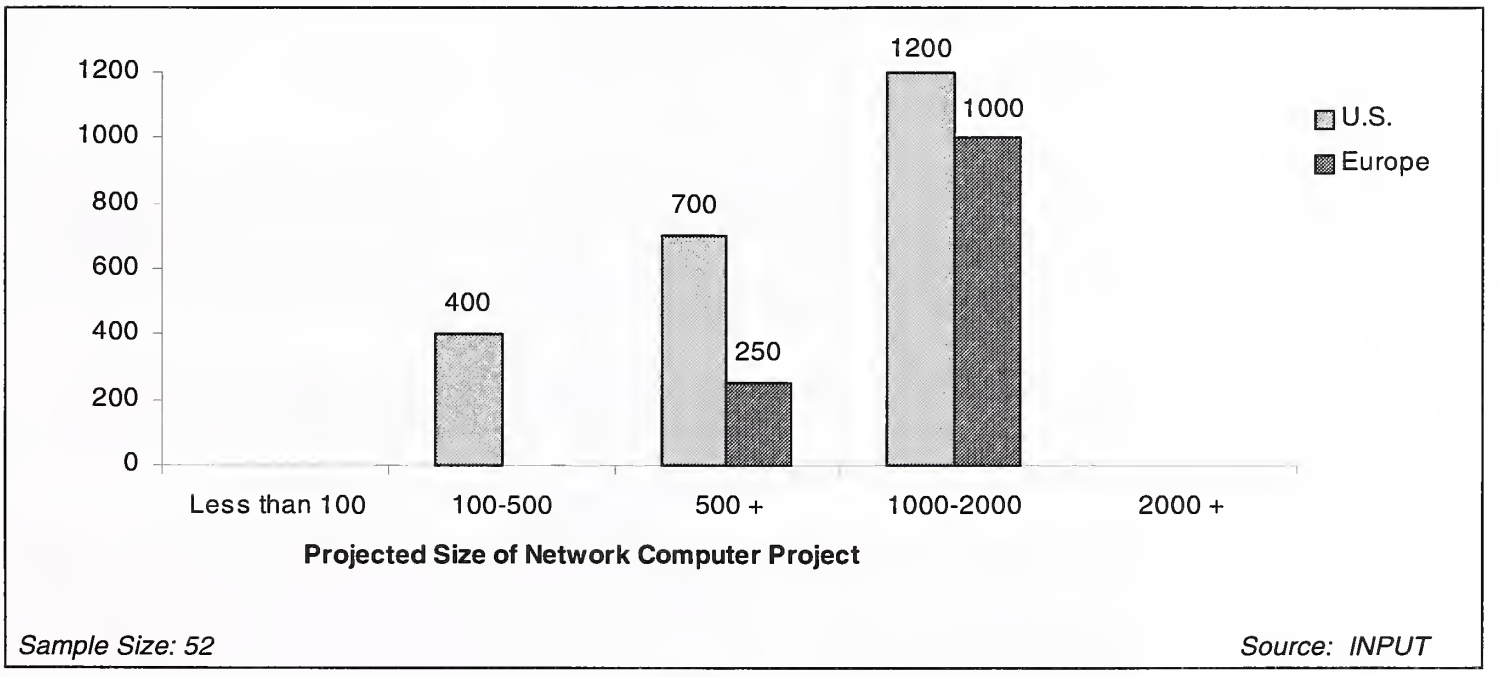
Exhibit III-10 and Exhibit III-11 summarize survey responses regarding NC projects projected through year-end 1998 and 1999.

Among respondents, only a few European and American banks plan projects involving 1,000-2,000 units, and no bank reports plans for a project larger than that. Only one American bank anticipates a small-scale project and, in mid-range projects, European bank project will typically be less than half the size of the American ones.

The absence of any commitment to larger-scale projects reinforces the conclusion that banks are still in the early stages of their evaluation of NCs. To date, no bank appears ready to commit to a major PC-to-NC migration.

Exhibit III-10

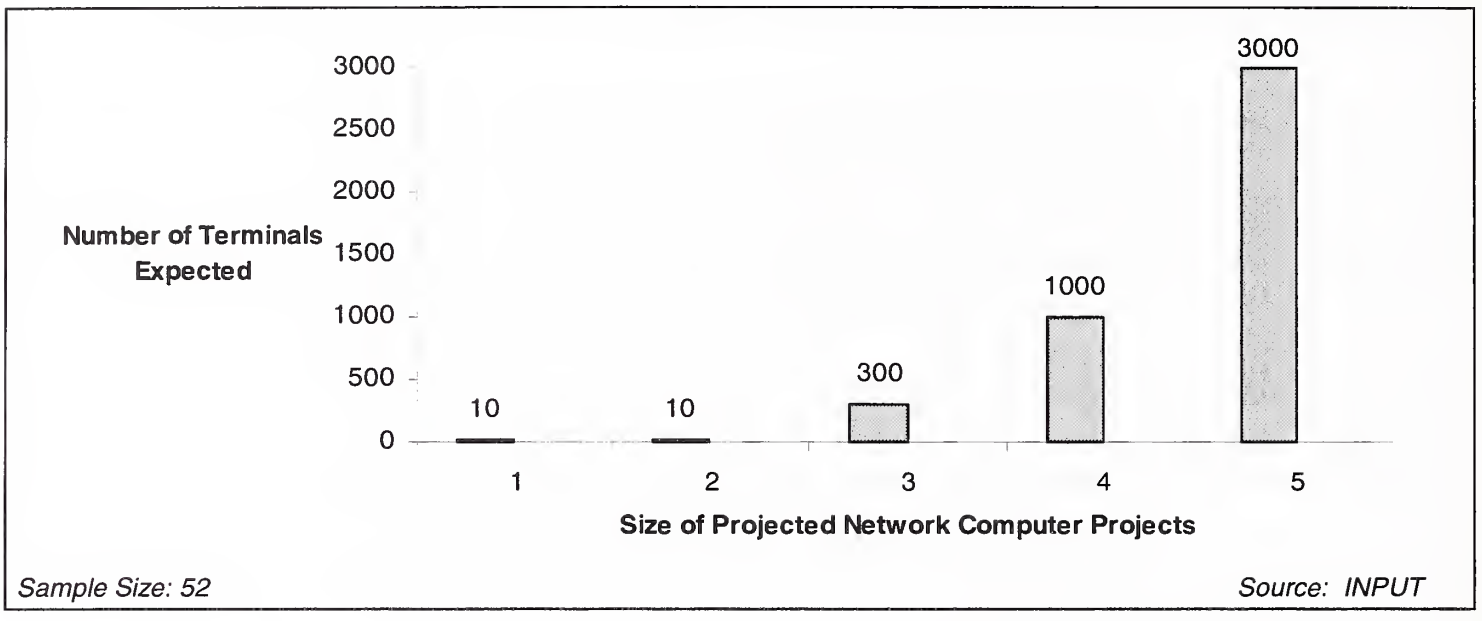
Projected Network Computer Installations, Year-end 1998



Sample Size: 52 *Source: INPUT*

Exhibit III-11

Projected Network Computer Installations, Year-end 1999



Sample Size: 52 *Source: INPUT*

The larger, 3,000 unit NC project expected in 1999 should not be interpreted as representing any trend among banks, as there is no corroborating evidence to this effect.

On the contrary, most of the projects anticipated for 1999 are small-scale pilots that may not be followed by larger commitments. Exhibit III-12 should be used as a more accurate indicator concerning the probability of any potential technology migration among banks.

Significantly, "better use of resources" and "cost-savings" ranked most highly as reasons for nonuser interest in NCs (and these are, in reality, variations of the same benefit).

However, "cost-savings" per se was outranked by "better use of IT", which is a broader measure, including efficiency, organizational rationalization and logistical factors. INPUT's survey indicates that bank decisions regarding NCs will not be made using cost-savings alone as a criterion.

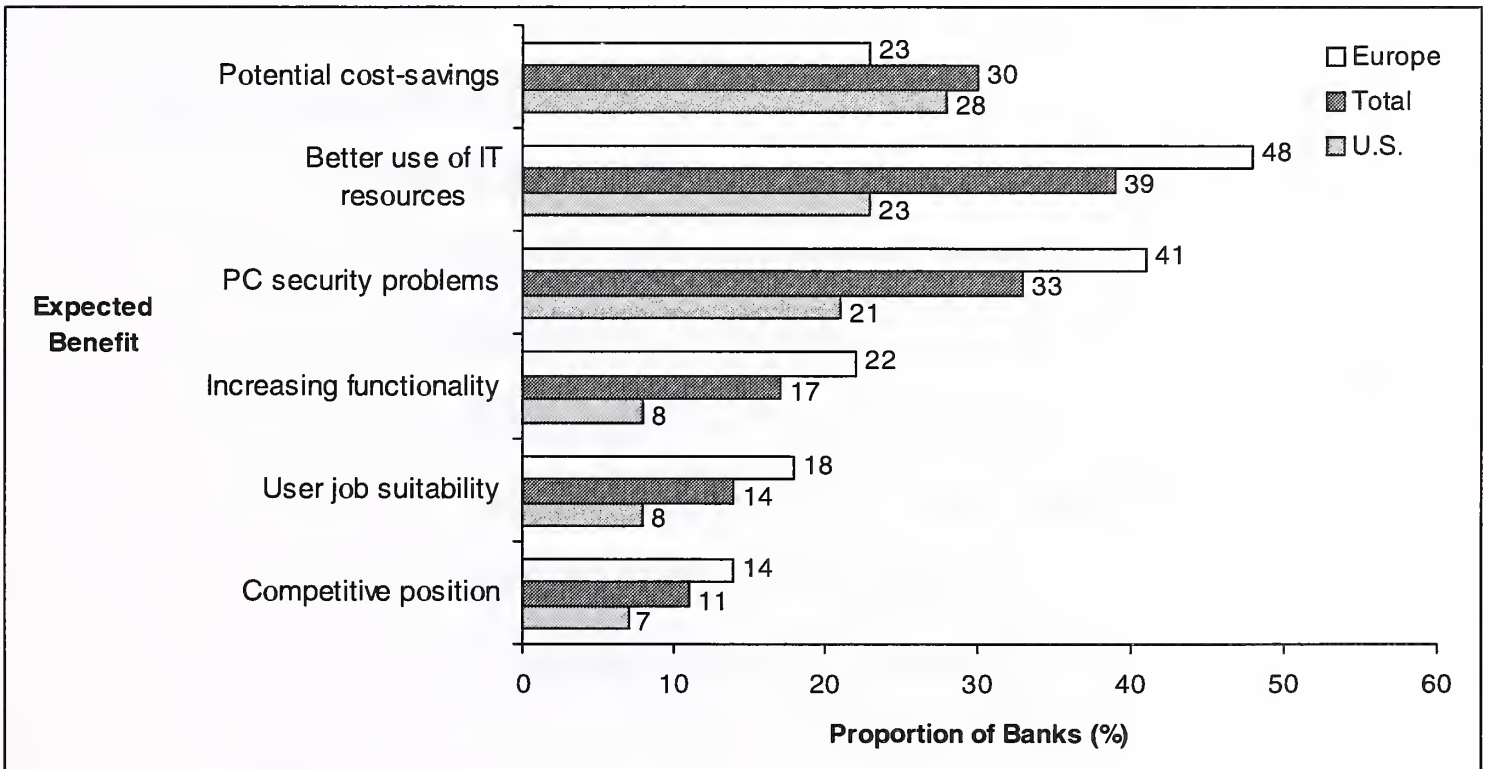
Exhibit III-12 shows marked discrepancies between European and American bankers' responses.

For example, almost double the number of Europeans than Americans ranked "better use of IT resources" as "important" or "very important" as an explanation of their interest in NCs. Similarly, American responses lagged behind European ones on all other points, including "competitive position."

In fact, the highest rating among American bankers—24% for "potential cost-savings"—should also be considered low. By extension, it means that more than 70% of American bankers **did not** consider "cost-savings" to be an important reason for their interest in NCs and only half as many Americans as Europeans rated "PC security problems" as a motivating factor.

Exhibit III-12

Reasons for Nonuser Interest in Network Computers



Sample size: 40
Percentages show the number of responses at the level 4 or 5 on a 1-5 scale (4=important, 5= very important)

Source: INPUT

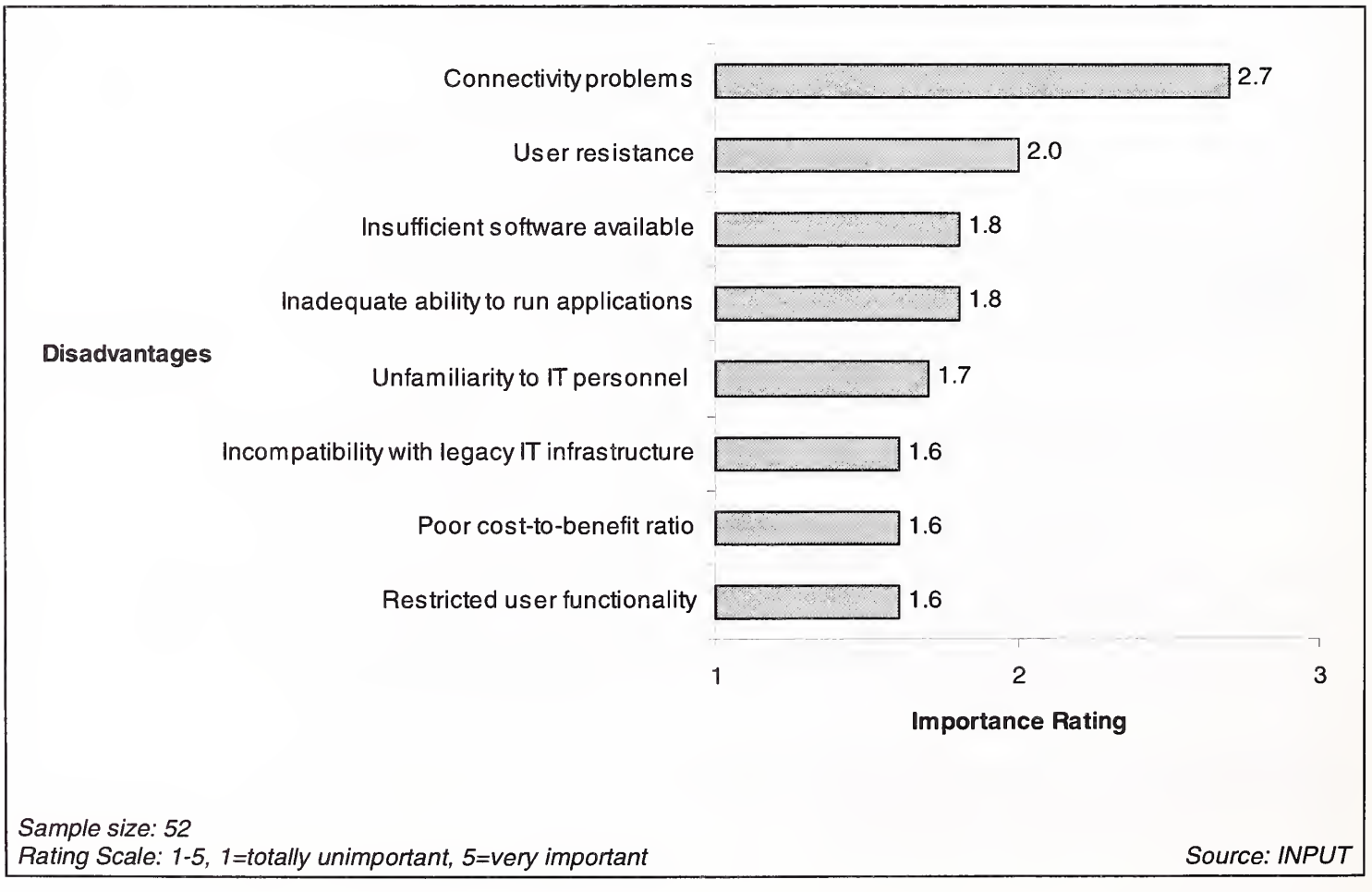
Banker ratings of "potential disadvantages of network computers", shown in Exhibit III-13, probably serves as a better indicator of the trend of bank thinking regarding NCs than comments concerning "reasons" as indicated in Exhibit III-12.

Here "connectivity problems" and "user resistance" are rated most highly as potential disadvantages of NCs. However, it is important to note that **none** of the items listed elicited any responses at the 4 or 5 level ("important" and "very important"). By extension, all of the responses indicated in Exhibit III-13 carry reflect relatively low levels of importance given to them by bankers.

When viewed in a wider context, survey results suggest that bankers are waiting to be sold on the advantages of NCs. At present, perception of potential disadvantages represents only a small factor in their decision-making.

Exhibit III-13

Potential Disadvantages of Network Computers



Sample size: 52
Rating Scale: 1-5, 1=totally unimportant, 5=very important

Source: INPUT

In many respects, the responses reflected in Exhibit III-13 should be interpreted as the obverse of earlier survey results.

For example, in previous exhibits, bankers indicated that they believed NCs to have a **good** cost-to-benefit ratio, making that factor an advantage and not a disadvantage.

Similarly, despite earlier comments that suggested a groundswell of resistance to the NC concept (no user access to resident software or disk drives), when asked specifically about user attitudes, "user resistance" was rated only 2 in importance on a 1-5 scale as a disadvantage.

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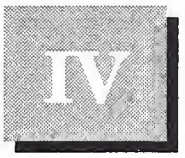


Analysis of the Network Computer Buying Process

A
Selection and Evaluation Process

1. Catalysts for Action on Network Computer Projects

According to INPUT research, there is a trend away from desktop machines defined by what they process to desktop machines defined by what they access.

The question becomes, in the words of one observer, "How do you optimize the desktop machine as an access window?"

According to this view, the NC represents an evolutionary step in that direction and, as a result, will be increasingly accepted by users who want to maintain or enhance functionality while reducing the costs associated with IT network support. These costs are variously estimated at $3-6,000 per PC user, depending on how broadly one defines PC support. In theory, NC costs aggregate to less than half of this amount, based on lower initial hardware prices and much lower on-going support costs.

As intensive transaction processors, cost-savings should be a particularly potent catalyst for banks to move in the direction of NCs, if not beyond them to WebTVs and related "Internet appliances" that cost even less than NCs.

Oracle's wholly owned subsidiary, Network Computer, Inc., in June 1997 introduced the "Network-In-a-Box" product that represents a "shrink wrap" solution for small businesses, schools and government institutions.

- The box includes two NC units, two NC smart cards for private, network access, a Systems Administrator card, network cabling and port devices, selling for just under $5,000.

- Although such a product would only be attractive to the smallest banks, it does offer dramatic evidence of the end-point potential envisioned by NC advocates.

Larry Ellison, Oracle Corporation's CEO, has proclaimed that, at a price of $500, or less—including a suite of Java-based software applications, NCs will be "practically disposable" and they will not need, in his words, "an expensive army of engineers to maintain the systems."

INPUT research reveals that bankers are receptive to the potential of NCs to deliver significant cost-savings, but it is difficult to envisions banks ever considering their NCs "disposable" at the time of the next technology upgrade. More likely, the ultimate catalyst for movement by a sizeable number banks toward adopting NCs will be vendor success in selling them on a mix of benefits, of which cost-savings are only one element.

As indicated earlier in this report, other important benefits include enhancing transaction security and rationalizing IT support resources.

Yet, there is little doubt that Microsoft and Oracle are both responding to growing corporate demand (including banking) for more affordable and more efficient client-server infrastructure alternatives.

2. Preferred Vendors

Exhibit IV-3 captures provisional survey data concerning vendors and subsequent exhibits show bank ratings of their satisfaction with vendors used.

3. Bank Decision-making Structure

INPUT's survey established the decision-making structure used by banks to determine whether, or not, to commit to a NC pilot project, or more extensive installation.

In addition, the survey analyzes distinctions in regard to the decision-making process between user and nonuser banks, as well as between American and European banks.

Exhibit IV-1 gives examples of representative responses give by bankers. Survey results as a whole revealed neither a distinct difference between the decision-making process used for NCs in comparison with PCs, or other IT expenditures, nor did they show great differences between American and European banks. Furthermore, the process appeared similar at both NC user banks and nonuser banks.

The salient point to note in regard to Exhibit IV-1 is the emphasis implied by the responses listed on a group decision-making process. Perhaps even less than is the case with other types of expenditures, the NC decision must clearly result from a positive consensus among a variety of bank staff.

Exhibit IV-1

Decision-maker Responsible for Network Computer Project

Decision-maker
Team
"High-level management"
LAN administrator
Chief Information Officer
"Organization Department"
Information Technology Manager
Branch Manager
"Group"

Sample size: 52 *Source: INPUT*

Exhibit IV-2

Network Computer Project Decision-makers, According to Nonuser Banks

Decision	US Banks	European Banks
Decision to initiate NC pilot project	CIO, "Standards Board", "Corporate Technical Group", "Technical Department", "International Communications Division", "Technical Services Division", "Senior IT staff", "Systems Support"	"Applications Development Department", "Director of Bank and Organizational Management", Director of Information Systems", CIO, "Purchasing Team", "IT Architecture Team", "IT Department", CEO, "Department Head"
Budget allocations	CIO, "Senior IT staff", "Team effort"	CEO, "IT Department", "Purchasing Department", "Director of IS"
Upgrades required	Network support, Communications division, "Distributed Company Unit", "Team effort"	CEO, CIO, Consultants, "Application Development Department"
Shift from PC to NC	CIO, Department head, Communications Division, Network Support, Standards Board, "Technical Services Division"	CEO, CIO, IT Department, Team

Sample Size: 50 *Source: INPUT*

Note that European respondents included the "CEO" as an element in **every** NC-related decision. In contrast, **no** American banker included the CEO. Also significant, although survey respondents refer to desktop users and potential "user resistance," end-users of NCs figure nowhere in bank decision-making structures as reported.

B
Vendor Selection Criteria

The vendors noted in Exhibit IV-3 were listed by bank users of NCs as primary sources for NC equipment and NC-related services. They will be discussed in greater detail in Chapter V, section F, where case studies of bank NC users are analyzed in detail.

"General Electric" was an unexpected name that merits closer attention in Chapter V.

Exhibit IV-3

Users' Primary Network Computer Vendor

Primary Vendor Named		
Hewlett-Packard	Compaq	Olivetti
Sun Microsystems	General Electric	Siemens-Nixdorf
Digital Equipment Corporation		

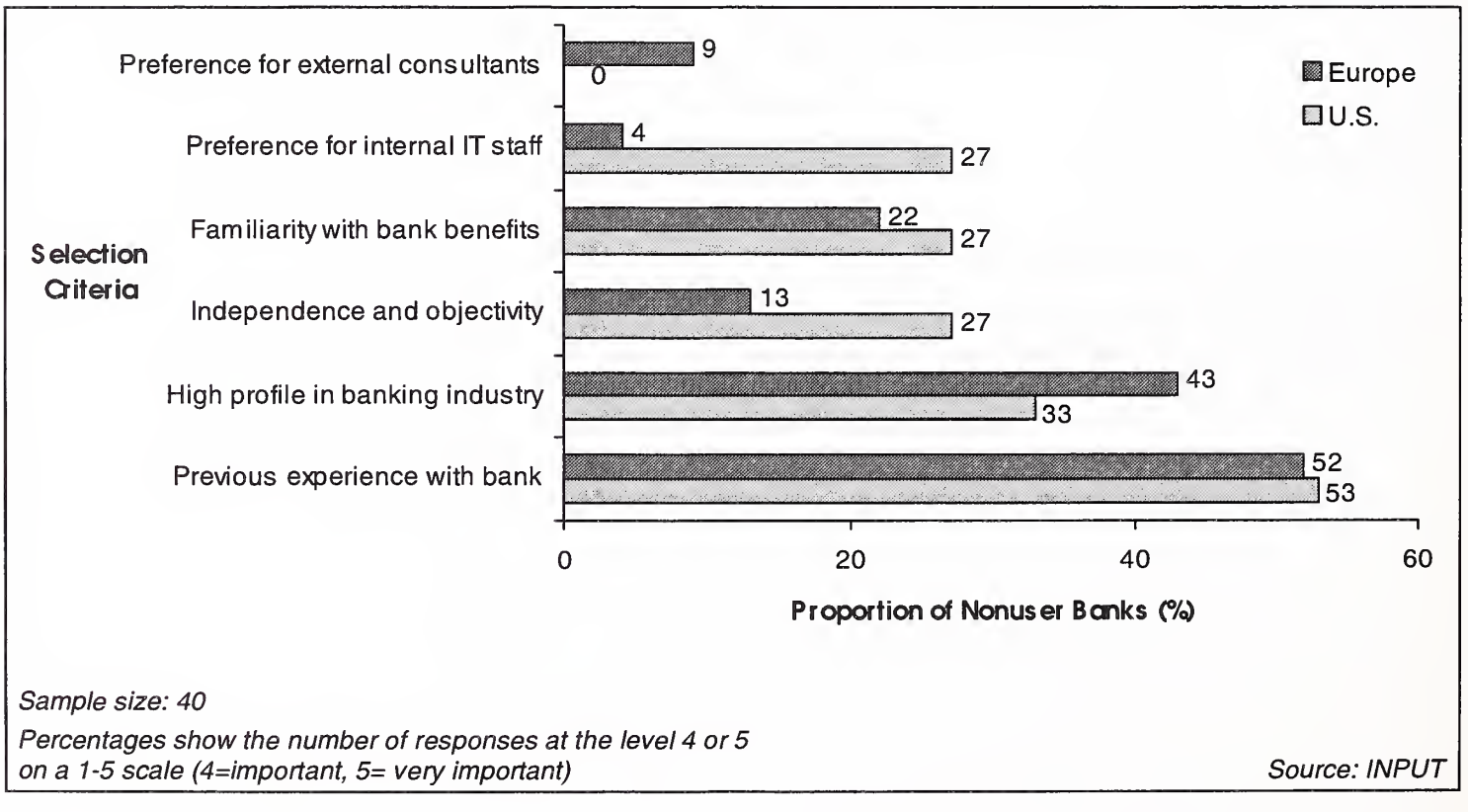
Sample size: 12 *Source: INPUT*

Exhibit IV-4 shows survey responses in regard to the criteria used by banks that have not yet committed to a NC pilot project. "Nonusers" were highlighted in place of "users" for two reasons: the sample size of nonusers was much larger, and—for that reason—more representative; also, the selection criteria used by nonusers will have greater value in determining the direction of future IT spending.

Both American and European bankers expressed a high preference for vendors with prior banking industry experience. However, there was a strong divergence of response on the topic of external consultants. European banks were much more inclined than American banks to prefer using external consultants (9% versus zero); in contrast, American banks were much more likely to prefer using their own internal IT staff (27% versus 4%). Related to this, Europeans put a much lower priority on vendors having "independence and objectivity" than their American banker counterparts (13% versus 27%).

Exhibit IV-4

Nonuser Bank Selection Criteria for Network Computer Vendors



Sample size: 40

Percentages show the number of responses at the level 4 or 5 on a 1-5 scale (4=important, 5= very important)

Source: INPUT

C
Vendor Ratings by Banks

As before, Exhibit IV-5 reveals a series of strong differences between American and European bankers in regard to vendor ratings.

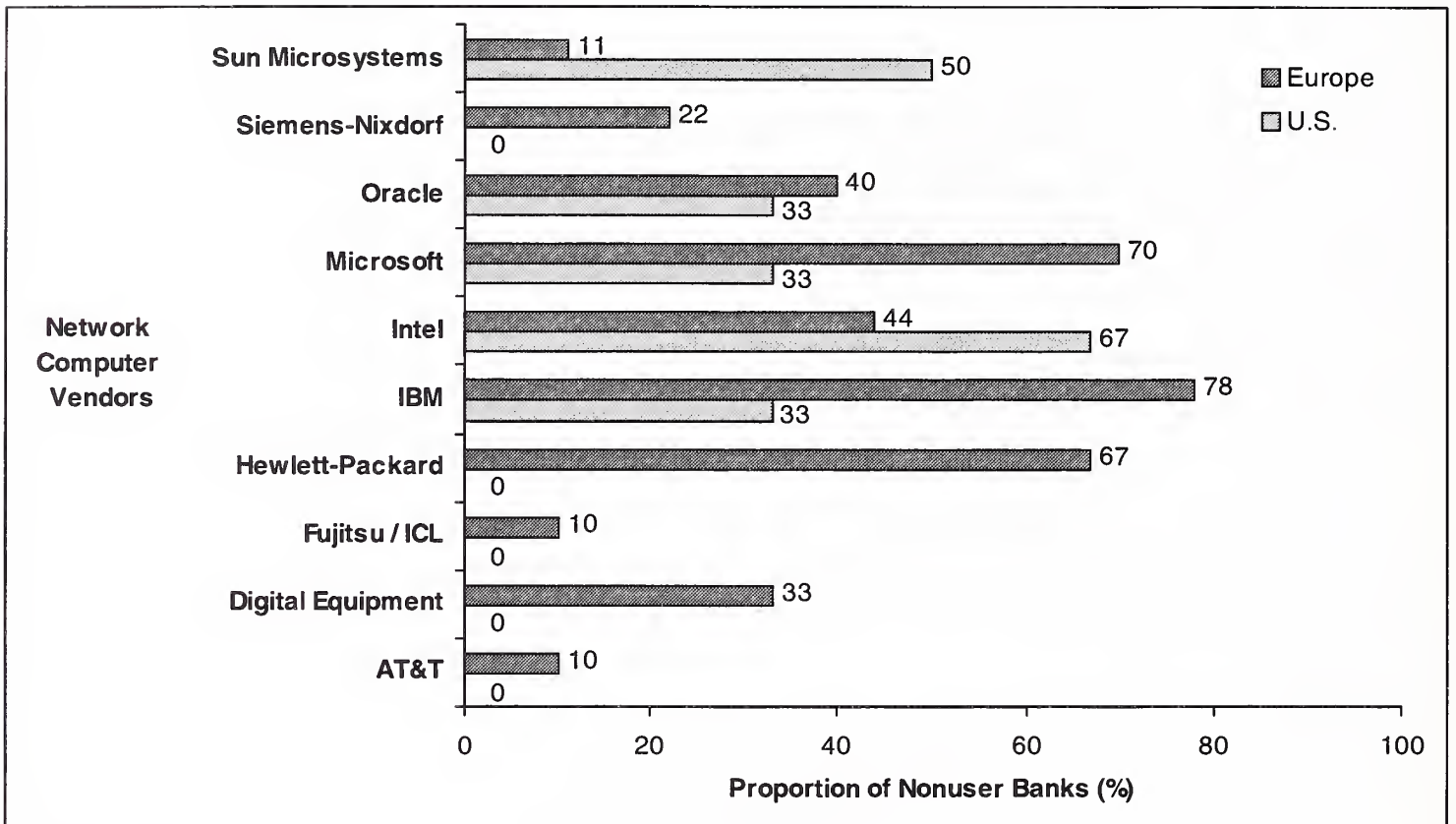
In this case, bankers were not asked to rate the performance of vendors actually used because responding banks had not as yet made any commitment to a NC pilot project. The ratings, however, were linked to NCs in an attempt to determine which vendors banks would be likely to prefer at the time when they did commit to a NC project.

It is important to remember that the experiences on which these ratings were based likely covered a wide range of prior IT work and cannot be interpreted as predicting which vendors are, in fact, most competent in the area of NCs. However, the extent to which potential vendors of NC equipment in the future are rated poorly now probably shows an accurate trend for future IT expenditures for NC projects.

The survey question on which Exhibit IV-5 was based specifically asked which vendor respondents were likely to prefer in the event that the bank initiated a NC pilot project.

Exhibit IV-5

Network Computer Vendors Rated by Nonuser Banks



Sample size: 40
Percentages show the number of responses at the level 4 or 5 on a 1-5 scale (4=important, 5= very important)

Source: INPUT

With the exception of Sun MicroSystems and Intel, European bankers rated all of the other vendors listed more highly than did American bankers.

Conversely, the results show that Sun and Intel appear to have significantly higher profiles among American banks than other large vendors that are active in many industries.

It is also worth noting that, despite being a European vendor, Bull attracted no rating at the 4 or 5 level ("important" or "very important)" and ICL attracted only 10% of ratings at that level. While IBM attracted a very high level of European 4 and 5 ratings (78%), only 33% of American banks did so.

It may come as no surprise that Siemens-Nixdorf's rating was high in Europe, reflecting its primary market, while no American banks gave it a high rating, it does come as a surprise that Hewlett-Packard achieved a very high rating among European bankers (67%), but none from American bankers.

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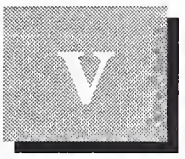


Do Network Computers Solve Real Problems?

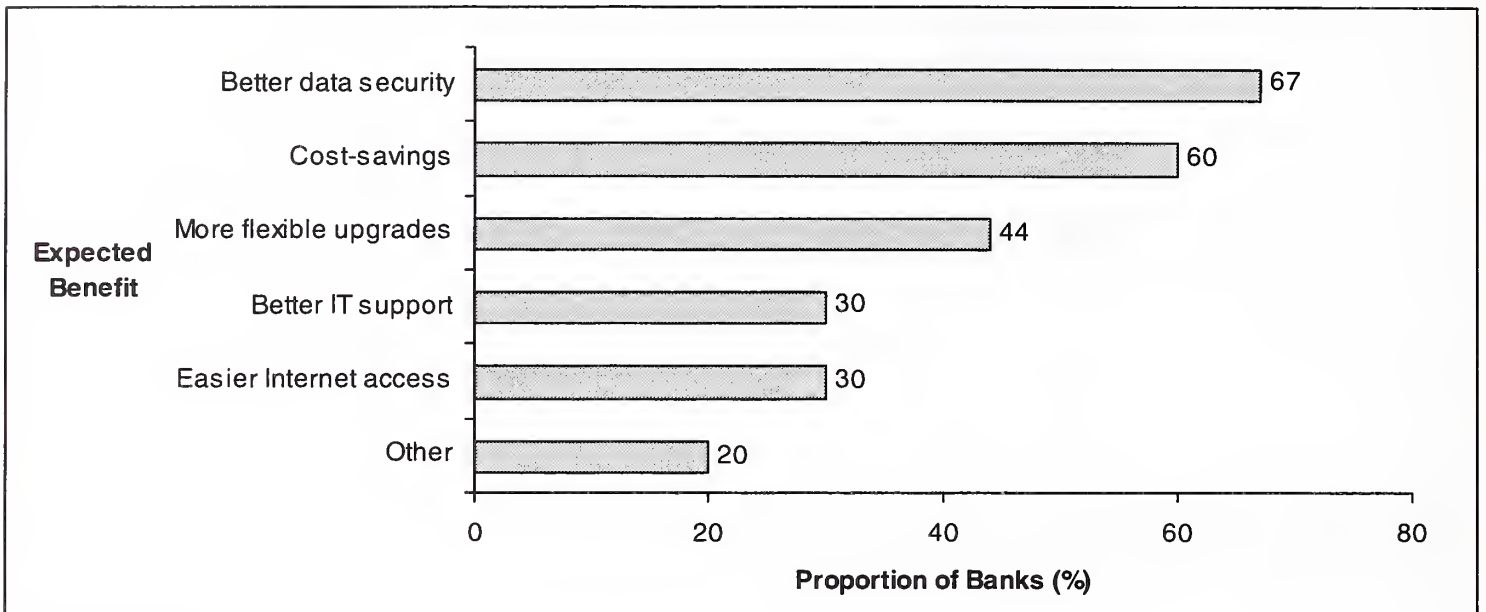
A
Benefits Anticipated by Users and Nonusers

Among banks that have implemented NCs and have experience in using them, "security" ratings outweighed those for "cost-savings" by seven percentage points. Despite the emphasis given to the potential for NCs to facilitate "better IT support," that benefit attracted only half of the ratings awarded to "cost-savings."

However, the more specific item in this area—"more flexible upgrades"—did attract a higher level of ratings, as would be expected. Also, despite promotion by Sun and Oracle of the potential for NCs to be "Internet appliances" that use Java programming, only 30% of bankers who actually have NCs appear to be impressed with this perceived benefit.

Exhibit V-1

Benefits from Network Computers Expected by Users



Sample Size: 12
Rating Scale: Percentages reflect the number of banks that awarded each item a rating of 4 or 5 on a 1-5 scale, 1=totally unimportant, 5=very important

Source: INPUT

In contrast, benefits expected by "nonuser" banks of NCs showed several important divergences from the ratings awarded by "user" banks.

At the outset, it is important to note that Exhibit V-1 reflects the percentages of 4 and 5 ratings ("important" and "very important"). In contrast, **none** of the benefits listed in Exhibit V-2 attracted any 4 or 5 level importance ratings from among nonuser banks.

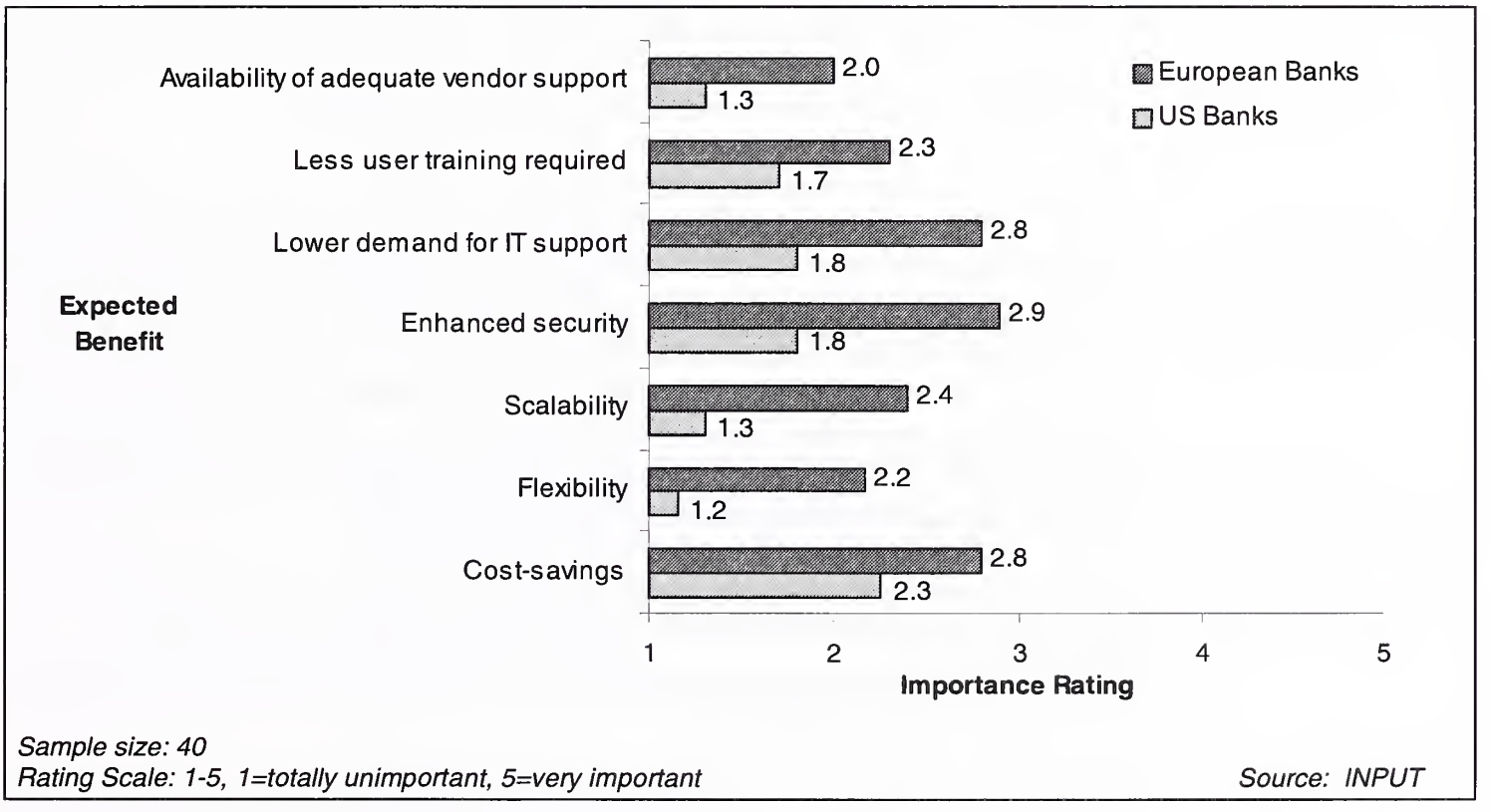
Although nonusers concurred with users on the attractiveness of NCs due to their potential to enhance data security, even that attracted a low importance rating—less than 3 from European banks and less than 2 from American banks.

As was the case previously, all of the European bank responses were at higher importance ratings than the American bank responses. In some cases, as with "scalability" and "flexibility," European importance levels awarded were almost double the American ones.

From this, it would be difficult not to conclude that NC nonusers are not impressed overall with NC expected benefits. This would reinforce the skepticism expressed earlier in this report concerning the likelihood that American or European banks were about to make large-scale new commitments to NC architecture within the next few years. With no rating above 3, which can be considered "neutral," nonuser banks are signaling that they may be interested in NCs, but they are not convinced regarding the NC's alleged advantages over PCs.

Exhibit V-2

Benefits Expected from Network Computers by Nonusers



Sample size: 40
Rating Scale: 1-5, 1=totally unimportant, 5=very important
Source: INPUT

Of course, this can be explained by a commonsense aspect of human nature: once a decision has been made and money spent—as in the case of NC pilot projects—expectations rise naturally because decision-makers are then being held accountable.

B
Budget Impact of Network Computers

Evidence from various sources suggest that the total cost of ownership of a pure NC environment can be about 20-30% less than the combined hardware, training, support and maintenance costs of PC networks. An IBM spokesman estimates the total cost of ownership of NCs to be about 40% lower than PCs. However, hard evidence for this claim is difficult to obtain. Banks surveyed had insufficient experience with their NCs to verify the extent of their savings, though—as subsequent exhibits document—the promise of achieving significant cost-savings constitutes an important criterion in their decision-making process.

Overall, bankers—like NC users in other industries—hope to see their real savings only after 3-4 years when desktops don't require individual upgrading or replacing when the next cycle of technological change occurs. In particular, software upgrade cycles have typically required ever more powerful PCs, which tended to either offset or exceed any productivity gains that resulted. NCs obviate this cycle by drawing on a server for both applications and data. Beyond that, bankers NCs attract bankers by the benefit of standardization that they offered. Because of their centralized configuration, they eliminate desktop duplication.

Also, bankers expect their operations to be markedly more productive with the same headcount due to reduced down time resulting from desktop-level down times, and because NCs can be configured to be very fast, even without local drives.

Exhibit V-3 reflects representative survey responses on the topic of NC project costs. Because responses were sketchy and incomplete (due either to lack of available information or proprietary concerns), one cannot draw any valid conclusions. At best, survey responses indicate certain cost trends.

Bankers were asked to respond to budget questions either on an annual dollar-expenditure basis, or on the basis of total project dollars spent. Because the bulk of spending (22%) appears to be concentrated toward the lower end of the spending spectrum provided, it is clear that most bank user projects funded to date have been small-scale pilot projects rather than full implementations.

Columnar percentages total less than 100 due to omissions among survey responses.

Exhibit V-3

Network Computer Project Costs

	Annual	Total
Less than $250,000	11% of users	None
$250-750,000	22% of users	33% of users
$750,000-$1.5 million	None	None
+ $1.5 million	11% of users	22% of users

Sample Size: 12 *Source: INPUT*

The 11% of user banks that report spending over $1.5 million annually, or the 22% that have spent that amount on a total basis clearly represent a minority of pioneer banks whose experiences will be followed closely to determine if their success warrant new commitments by their peers.

The percentage budget allocations indicated in Exhibit V-4 corroborate the low cost represented by NC hardware (only 10% of total costs). At 5%, the allocation to software suggests that banks have made no substantial new purchases to support their NC projects, but have continued to use their legacy software with the new NC units.

Also, the small amount allocated to "upgrades" suggests that, prior responses notwithstanding, user banks have not generally had to spend significant amounts to increase bandwidth in order to accommodate their new NC system. One factor, however, may be the relatively small size of these pilot projects. Large-scale commitments to NCs would likely require revisions in the budget allocations indicated in Exhibit V-4.

The large (65%) share of budget taken by "implementation services" is somewhat difficult to evaluate. American banks (which represent the larger number of installed NC projects among current survey respondents) acted consistently with their stated preference for using internal IT staff, the amount indicated for "implementation services" may reflect internal accounting allocations.

On the other hand, it may reflect spending for unanticipated external consultants, despite their preference to depend on internal IT staff. Finally, this number reflects spending by European banks that expressed no such reticence for using external IT support.

True to promise, NCs were billed as requiring less end-user training and the budget allocations indicated in Exhibit V-4 corroborate that claim insofar as only 10% of total budget was allocated to training.

Exhibit V-4

Network Computer Project Cost Allocations

Type	% of Total Budget
Hardware equipment	10%
Software	5%
User training	10%
Implementation services	65%
Upgrades	5%
Other	5%

Sample size: 12 *Source: INPUT*

Survey questions attempted to elicit sufficient data to permit an accurate and specific comparison between costs incurred to support NCs in comparison with PCs. However, as was the case with similar budget questions, the responses provided were incomplete.

Nevertheless, the following provisional conclusions seem appropriate:

- PC costs are likely understated, although they do reflect the ratio of cost-savings expected for NC projects.
- User estimates of NC cost-savings varied and suggested that bankers really didn't have as yet any hard data concerning the magnitude of their cost-savings.
- Judging again by the small amounts indicated for NC project costs, these projects appear all to be small-scale pilots rather than full implementations.

Exhibit V-5

Current and Projected Project Costs

	Annual	Projected Year-end 1998
For PCs	$1,500 per user; total costs: $1-5 million	$300-500,000
For NCs	$750 per user; total costs: $250,000	$50-250,000
Estimated NC cost-savings	20-40%	
NC project completion		20-50% of total budget

Sample size: 12 *Source: INPUT*

All amounts are per-user, per-year, unless otherwise indicated (some respondents provided annual amounts). Note that Exhibit V-5 asked for data concerning bank PC expenditures, not NC. The goal was to provide a basis for comparison of levels of expenditure for the two types of desktop.

Exhibit V-6

Annual PC Expense Anticipated by Nonuser Banks

Region	Capital Investment	IT Support
US banks	• $1,500 per user, per year [$1.8 million total PC acquisition cost] • $3-4,000 • $2,500 [$20 million annual total] • $1,600 • $750	• $1,500 per user • $3 million total
European banks	• 1.3 million Swiss francs ($885,860) • £14,000 total • £70-80 million total [$115-132 million] • £2-3,000 per user [$3,294-4,941] • Dfl 60 million total (Dutch guilder) [$29.4 million]	• 1,000 Swiss francs per user ($681) • £2,000 per user [$3,294) • Dfl 40 million total (Dutch guilder) [$19.6 million] • SKr 50,000 (Swedish krona) [$6,240]

Sample size: 40 *Source: INPUT*

Recalling figures provided in previous exhibits, such as Exhibits V-3, 4 and 5, at best one can conclude that these figures appear to corroborate the claims made by NC advocates. Careful examination of amounts listed in Exhibit V-6 suggest that bank costs to support PCs are, in fact, at least 60% higher than those required to support NCs.

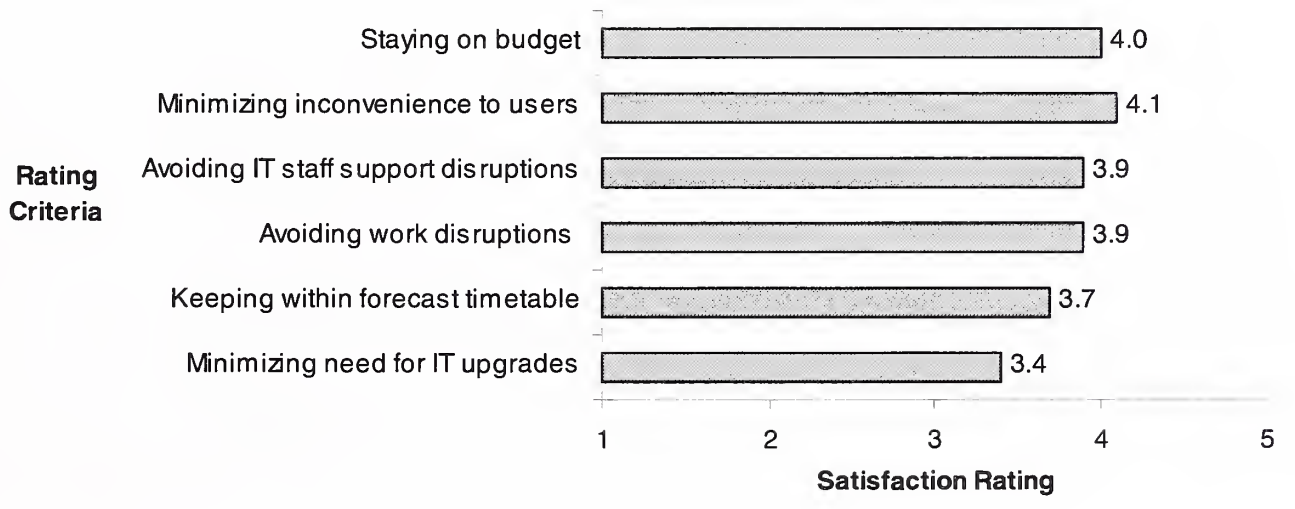
C
Evaluation of the Network Computer Implementation Experiences

1. Problems Encountered and Their Solutions

Virtually all of the user bank ratings shown in Exhibit V-7 reflect high satisfaction ratings with the implementation process for NC projects. Clearly, the "staying on budget" item with a 4 rating ("important" on 1-5 scale, 5="very important") was the most significant. Also worth noting, the 3.5 rating for the item "minimizing the need for IT upgrades" since the expense of required IT infrastructure upgrades has been considered by some an obstacle to NC adoption. The 3.5 rating, slightly more positive than neutral, suggests that this topic was not an area of concern during NC project implementations.

Exhibit V-7

User Satisfaction Ratings of Network Computer Implementations



Sample size: 12

Scale: 1-5, 1=very dissatisfied, 5=very satisfied *Source: INPUT*

Exhibit V-8 captures a range of responses related to bank NC project implementations. Consistent with the ratings in Exhibit V-7, banker comments clarified that bandwidth upgrades were, in fact, required but expenditures could be staggered.

Also important, 72% of all respondents reported no significant implementation problems, which is very positive and reflects the reduced complexity of NC systems in comparison with PCs. The comment "lack of diskette drives" suggests that NCs required a substantial re-orientation on the part of users concerning how they used their desktops to complete their work.

Most importantly, perhaps, 82% of respondents reported no security problems in connection with their NC installations--considering that security issues had been rated a major concern of survey respondents. Enhanced network security had been one of the most important benefits sought by banks from NC projects. Based on the responses shown in Exhibit V-9, those benefits were realized.

Responses concerning the item "WAN upgrades" complement the first, general question concerning new demands made by NCs on the existing IT infrastructure. Only 17% of respondents reported requiring WAN upgrades. Responses elsewhere suggest part of the reason: WAN upgrades have been required for other reasons, unrelated to NCs, so that—while necessary—the expenditures cannot be attributed to the NC project.

Exhibit V-8

Users' Network Computer Implementation Experience

Aspect	Experience	Comment
New demands on existing IT infrastructure?	Needed additional: communication bandwidth, training, workstation upgrades, software conversions	Not all required at each installation
Grant customer access to network computers?	30% "yes," 70% "no"	Used terminal emulation; gave access to home-banking applications
Significant implementation problems?	27% "yes", 72% "no"	Difficulty getting applications to work properly Lack of diskette drives Adequacy of hard drives
How resolved?		In-house; service technicians; still unresolved
Security problems?	18% "yes," 82% "no"	Password problems; problems in computer set up access (too wide)
WAN upgrades required?	17% "yes, 83% "no"	Needed bandwidth, new routers, full upgrade to 32-bit technology

Sample size: 12 *Source: INPUT*

2. Project Time Horizons and Dollar Costs

Exhibit V-9

Duration of Network Computer Project

Project Phase	Time Elapsed	Comment
Total project schedule	Average of 12.2 months	Range: from two months to three years, or more
Product / vendor evaluation	Average of 5.7 months	Ranged from 2-12 months
Complete hardware / software installation	Average of 7.8 months	"It took way too long."

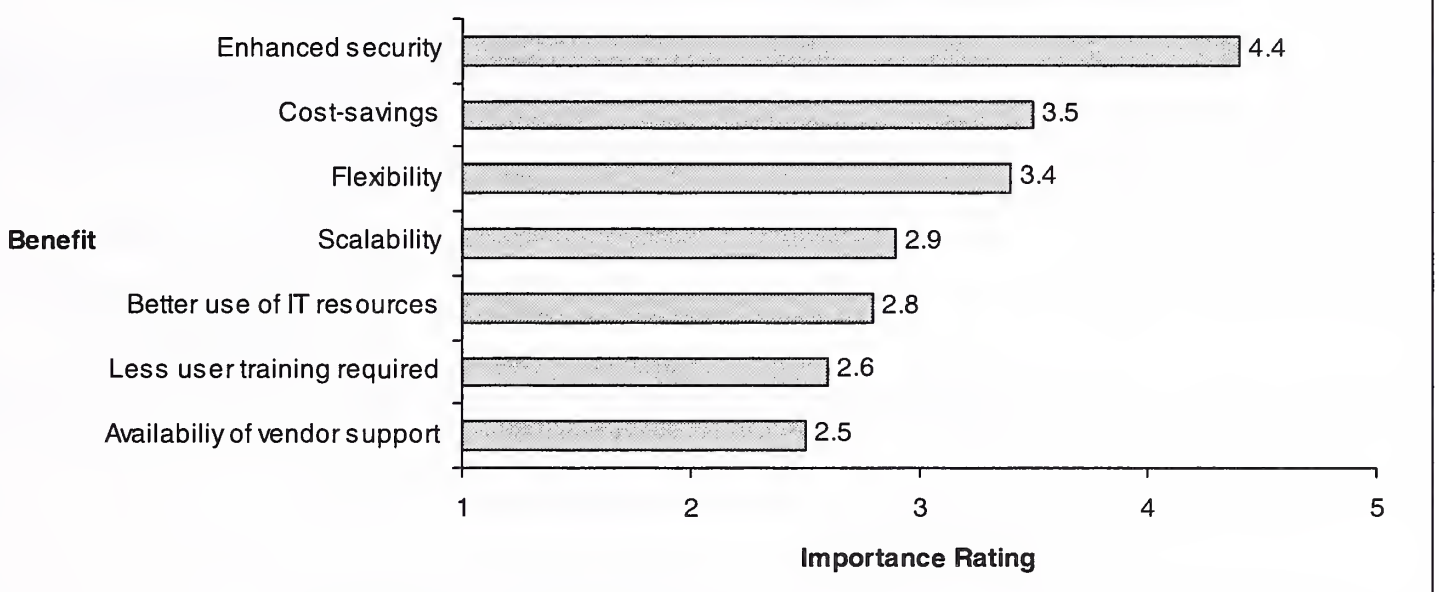
Sample size: 12 *Source: INPUT*

D

Banker Satisfaction with Network Computers

Exhibit V-10

Rating by Users of Benefits from Network Computers



Sample size: 12
Rating Scale: 1-5, 1=totally unimportant, 5=very important

Source: INPUT

E
Impact of Network Computers on Existing IT Infrastructures

Exhibit V-11

Expected Network Computer Demands on Existing IT Infrastructure, According to Nonuser Banks

Expected New Demands	Expected WAN Upgrades	Comments
"Different type of IT support" "Adaptation problems" "New demands on data communications capacity"	US banks, 13% "yes" European banks, 9% "yes" Worldwide average, 10%	"Over time, large increase in bandwidth" "High-speed bandwidth" "We have other reasons apart from network computers to upgrade the WAN."

Sample size: 40 *Source: INPUT*

F
Case Study Analyses

The case studies that follow provide valuable insights into the field experiences of banks in the U.S. and Europe in implementing NC projects.

Projects displayed a wide range of characteristics, from very small pilot projects to large-scale, multi-location systems, urban to rural, and covered a broad array of banking applications.

Bank satisfaction ranged significantly. Some banks reported being extremely satisfied with their NC projects; others used the NC pilot as a basis to initiative a return to PCs, based on problems and disadvantages encountered.

1. Bank A: McLean, Virginia, U.S.A

This Virginia bank has an installed base of 4,000 PCs and 200 NCs. However, the NC count is expected to decline to 40 by year-end 1998.

The network uses a hybrid operating system including Windows NT and Windows 95, with plans to move to Windows NT exclusively in the future. At present, NCs are used primarily for mortgage financing transactions. NCs were considered particularly suitable for trading room and help desk operations. The bank has no clear expectations concerning what new applications will be run on them over the next few years.

In regard to benefits expected, increased functionality was rated more important than cost-savings.

Sun MicroSystems was the primary vendor used. The bank appreciated, in particular, Sun's experience, reliability and expertise. It was chosen only after a careful analysis of all competitor vendors active in the area of NCs.

Upgrades required: additional bandwidth.

2. Bank B: Brooklyn, New York, U.S.A.

This Brooklyn bank has an installed base of 300 NCs at present and expects to expand to 1,000 by year-end 1999.

The network operates in a Novell environment. The IT manager prefers Novell, but reports that availability of applications may compel him to move to Windows NT, or a combination of both, over the next two years.

Currently, NTs are used various banking applications, including: Treasury, investment securities transactions, and marketing.

The most important NC benefit gained to date has been scalability. Cost-savings, flexibility and enhanced security ranked next in importance, along with good availability of vendor support.

The bank's primary NC vendors were Compaq and Novell. Compaq rated highly for support.

The most significant problem encountered was the unavailability to users of desktop hard disks. Resulting difficulties have still not been resolved.

The bank expects to spend $250-500,000 annually on NCs. In 1998, the bank expects to spend half of its IT budget on NC-related costs.

3. Bank C: Bremen, Germany

This German bank has an installed based of 1,000 PCs and 50 NCs. By year-end 1998, it expects to have no NCs in operation, signaling a failed pilot project.

The network operating system is Windows NT and the NCs are being used primarily for communications applications. Specifically, NCs are being used to access communications data resident in the server. Next, the bank anticipates using NCs for Internet access.

The primary benefits anticipated from NCs were cost-savings and better data security. Both of these benefits were realized.

Siemens-Nixdorf was the primary vendor used.

The only significant reported problem was connectivity.

4. Bank D: Salt Lake City, Utah, U.S.A.

This Salt Lake City bank has an installed base of 3,000 PCs and 100-500 NCs. By the year-end 1998, it expects to have no NCs in operation.

The operating system is Windows NT and the NCs are being used currently for investment securities processing, word-processing and spreadsheet applications. No new applications are planned because the bank expects to phase out NCs by the end of the year when it will switch bank to PCs exclusively.

The decision to initiate a NC pilot project resulted from a detailed usage and cost study. However, none of the anticipated benefits were realized to any significant degree. On the contrary, the bank's pilot project convinced IT managers that PCs were more suitable to the bank's needs.

The most significant problem encountered related to security. As a result of an improper system set up, certain users were able to access unauthorized data.

5. Bank E: New Orleans, Louisiana, U.S.A.

This New Orleans bank has an installed base of 3,600 PCs and an equal number of NCs.

The network operating system is a hybrid combination of OS2 and Windows NT.

NCs are being used for all-important banking applications, ranging from ATMs to check processing and marketing.

The bank believe that it has achieved all of the benefits from NCs that it expected, including cost-savings, enhanced security, and better use of IT resources.

All banking applications have been used successfully on NCs.

IBM was the primary NC vendor and the bank rated it highly. GE was also used. The bank appreciated the high level of availability of vendor products and services.

In the future, the bank is considering making NCs available to a select number of customers for home-banking applications.

Concerning upgrades, the NC installation has required a new router and bandwidth increases.

Overall, the NC project took three years to complete and incurs annual NC support costs of $250-750,000. Total project costs exceed $1.5 million. In 1998, the bank expects NC-related costs to represent 20% of the total IT budget.

On an annual basis, NC support costs are running about half of those for PC support.

6. Bank F: Düsseldorf, Germany

This German bank has an installed based of 1,500 PCs and 3,000 NCs, with expectations to remain at that level through year-end 1999.

The network operating system is Windows NT and NCs are used primarily for branch banking applications. The bank continues to believe that NCs are most suitable for branch applications; it does not consider them suitable for Internet applications that are anticipated to be necessary in the near future.

The primary NC vendor used was Digital Equipment Corporation.

The most important NC benefit anticipated was better data security. This has, in fact, been achieved.

7. Bank G: Chicago, Illinois, U.S.A.

This Chicago bank has an installed based of 10,000 PCs and 500 NCs. It expects to expand the number of NCs to 700 by year-end 1998.

The network operates on Windows NT and the NCs are used primarily for branch banking applications. Within the next two years, the bank expects to use NCs for remote access services via terminal emulation.

The primary benefit expected was cost-savings, which has been achieved. Secondarily, the bank wanted to standardize its desktop network and render it more manageable.

Other important benefits achieved include flexibility, scalability and reduced demand for IT support.

The bank continues to believe NCs to be most suitable for branch banking and least suitable for Treasury applications. Management has considered making NCs available to certain customers via terminal emulation.

Hewlett-Packard was the primary NC vendor and the bank appreciated, in particular, the vendor's technical competence. Also, the bank was very satisfied with the vendor's ability to keep the NC installation on budget.

The installation took six months to complete, which the bank considered much too long.

Nevertheless, during the NC installation process, the bank encountered significant difficulties in getting applications to work correctly. Ultimately, these problems were solved in-house. Looking ahead, NCs will require increased bandwidth along with a general reconsideration of the IT communications infrastructure.

The most serious disadvantage encountered in regard to NCs has been connectivity. Remote access problems continue. In addition, users have been reluctant to give up their desktop A-drives and hard disks. Beyond that, NCs proved inadequate to fun certain banking applications.

Currently, the bank spends less than $250,000 annually on NCs. The total cost to complete the NC project was $250-750,000.
On an annual basis, NC expenditures break out as follows:

- NC equipment 10-15%
- Software 10%
- Infrastructure upgrades 10%
- User training 10%
- Implementation services 65%

On a per-user basis, the bank spends roughly $1,500 per user on PCs and an undetermined about on NCs. Nevertheless, the bank estimates that it is saving 20-40% in cost-savings on a total-budget basis.

8. Bank I: San Juan, Puerto Rico

This San Juan bank has an installed base of 500 PCs and 100 NCs, with plans to expand the number of NCs to 1,000 by year-end 1998.

The operating system is Windows NT used in conjunction with Windows 95.

NCs have been used primarily for ATM operations, distribution, programming and technical support. Within the next two years, the bank expects to use them as well for help desk functions. Beyond that, it expects to give select customers access to NCs for home banking in the future.

All expected NC benefits have been realized, including cost-savings, better IT support capability and better data security.

NCs are considered particularly suitable for accounting applications.

The primary vendor used was Microsoft for software and Olivetti for hardware. Both were rated very highly for their implementation work.

The most serious problem encountered during implementation was connectivity. In particular, there were incompatibilities between Novell and the network Windows NT server.

In addition, the NC implementation created new demands for training. Also, there were password security problems.

In the future, the bank is considering a WAN upgrade as a result of its NC project implementation.

9. Bank J: Albuquerque, New Mexico

This Albuquerque bank has an installed base of over 500 PCs and 100-500 NCs. At present, there are no plans to expand the installed base of NCs.

The primary operating environment is Novell, but the bank expects to switch to Windows NT over the next two years.

To date, NCs have been used successfully for all-important banking applications.

Significantly, the decision to implement NCs was a decision of the bank CEO.

The most important NC benefit anticipated was better data security. However, based on experience, the bank is even more pleased with the cost-savings and flexibility achieved through NCs.

In particular, NCs are considered suitable for customer service applications. To date, the bank has encountered no banking applications for which NCs were unsuitable.

The primary NC vendor was Cisco Systems. Secondarily, the bank used Compaq, Hewlett-Packard and IBM. Compaq supplied the NC equipment. Overall, the bank appreciated the quality of service and technical support offered by these vendors.

Regarding disadvantages of NCs, the bank reported three important items:

- Insufficient availability of hardware.
- Connectivity problems.
- User reluctance to give up their A-drives and desktop hard-drives.

The most important area of bank satisfaction during the implementation process was the ability of vendors to complete the project while incurring a minimum of disruption to users.

In the future, the bank anticipates that additional workstation upgrades will be required. Also, it is considering making NCs available to customers.

Overall, the NC implementation project took 12 months. Regarding costs, the bank spent over $1.5 million on the project and expects to save over $300,000 annually as a result of the project.

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