

What Every Loan Officer Needs to Know about the Year 2000 Computer Problem (But Doesn't Know How to Ask)

by Jay Golter and Paloma Hawry*

On May 5, 1997, the Federal Financial Institutions Examination Council (FFIEC) issued an inter-agency statement about the Year 2000 problem, giving guidance on what financial institutions need to do to assure that they do not suffer serious computer-system failures related to the change of century on New Year's Day 2000.¹ One section of the statement specifically addressed the potential credit risks that could arise from a borrower's inability to manage its own Year 2000 compliance efforts successfully:

"Financial institutions should develop processes to periodically assess large corporate customer Year 2000 efforts and may consider writing Year 2000 compliance into their loan documentation. Loan and credit review officers should consider in their credit analysis of large corporate customers whether the borrower's Year 2000 conversion efforts are sufficient to avoid significant disruptions to operations." (FFIEC (1997), 4.)

Moreover, the FFIEC anticipates issuing further guidance on Year 2000 issues, including those related to credit risk. Analyzing the scope of any firm's Year 2000 challenges is difficult for professional systems consultants, let alone for the typical loan review officer, who has a limited understanding of computer programming and systems integration and might feel ill-equipped to conduct the type of analysis called for in the inter-agency statement. The purpose of this article is to explain the nature of the Year 2000 problem and the dangers it can create for different organizations. The article discusses the types of risk that emanate from these system problems and proposes a process by

which a bank's loan department may establish policies to assess and mitigate credit risk resulting from Year 2000 issues. A list of reference materials is also included.

ORIGIN AND NATURE OF THE PROBLEM

In the Stanley Kubrick science fiction movie *2001: A Space Odyssey*, the computerized system operating a manned spacecraft has to be disconnected when it turns against the crew. One year earlier than predicted by the movie's title, many businesses may also find that their computers have turned against them, as many systems on which people depend cease to operate correctly. The problem lies in the inability of some computers to interpret correctly dates in which the year does not begin with 19—and failure to correct the problem before the immutable deadline could have dire results for any firm. In fact, many computer industry experts believe that unless firms have already made significant progress fixing the problem it is now too late for some of them to survive.²

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¹The authors' opinions, interpretations and representations regarding the FFIEC and its statements and policies, including the May 5 statement, are not to be relied on as FFIEC policy. The sole source of FFIEC policy is the FFIEC.

²For example, see Peter de Jager's remarks in Levy and Hafner (1997).

The origin of the problem is that early computer programmers had to work around the constraints imposed by limits on the size of computer memory and by the expense of storing data. One useful technique was to represent dates with an implied century. For example, a date field holding the value “01/01/56” meant “January 1, 1956” and not “1856” or “2056.” Use of this convention reduced the amount of storage required and improved the computer’s processing speed. Date fields were expanded only when necessary. For example, a mortgage system might have four-digit years for “maturity date” but two-digit years for “opening date,” “last payment date,” “next mailing date,” and so forth. The convention of representing years with two digits was also used when some components of systems with calendar functions (for example, the timer on a security system) were hard-coded.

Computer systems often use dates to determine how long something has existed (for example, to see whether it is time to perform scheduled maintenance in a manufacturing plant) and this determination is made by subtracting the earlier date from the current one. A system that orders a replacement part every five years, might record that a part was last being installed on June 1, 1992; on June 1, 1997 the system would calculate that “97/06/01” – “92/06/01” represented five years and that the part needed replacing. However, in the Year 2000, the system might conclude that the part is -97 years old (“00/01/01” – “97/06/01” = -97 1/2 years). How the computer would then proceed would depend on how the programming instructions had been written. Some systems might recognize the calculated age as being invalid and might generate a report listing such occurrences for further investigation. Other systems might leave the replacement parts unordered since they would never reach a calculated age of five years.

To the extent that the eventual consequences of using date shortcuts were contemplated during the 1960s and 1970s, it was believed that the underlying programs would be replaced well before the century changed and that if they were not, that there would be plenty of time to correct the problem. Even some programs written recently may contain some elements that will malfunction in date calculations after Year 2000. Now that the century is drawing to a close, however, the time left in which to correct this problem is rapidly shrinking.

The actual amount of time required to modify a system that has a century date problem can vary significantly depending on a number of factors. These include the age of the systems in operation; the num-

ber of systems in operation; the number of programs and lines of code in all systems; the number of computer languages in which programs are written (and the availability of programmers with skills in those languages); the quality of the system maintenance that has been performed (in particular, the extent to which documentation explains the purposes of each computer instruction); the extent to which electronic data are exchanged with other parties; and the degree to which the organization depends on equipment with embedded microchips that may not function properly in the next century. And what makes Year 2000 remediation programs particularly challenging is the need to (1) find *all* of the places where date problems might lead a program to miscalculate or terminate; (2) coordinate the repairs of all parts of the overall system so that no one repair interferes with the operations of other parts of the system; (3) test the repair by using data that accurately mimic the processing that will occur in the next decade; and (4) complete the project without any time extensions being granted.

Six Concentric Circles of Risk

To assess each bank’s credit-risk exposure to Year 2000 problems, it is necessary to understand the operational risks that Year 2000 creates for a bank’s borrowers.³ These risks are like ripples in a pond, moving outward from the center of the firm’s operations. The central risk lies in the firm’s computer systems that handle core applications. These functions traditionally were housed on mainframe systems, but recent developments in data processing have moved much of this activity onto other platforms. The second circle of risk encompasses networks and PCs that may be important in the day-to-day operation of a firm. The third circle of risk involves exchanges of data with third parties. The fourth represents equipment built around microprocessors that operate with internal calendars. Extending outside the company, the fifth circle is composed of business partners—those organizations that provide essential services or are key customers of the firm. Finally, the sixth circle of risk is represented by the macroeconomy which may be adversely affected by the disruptions that result from efforts to adjust to the uncertainties posed by this unprecedented challenge and from the failures of some to prepare successfully for the date change.

³This section is abstracted from the authors’ unpublished manuscript, “Circles of Risk,” which provides much greater detail about the areas that organizations need to address in their Year 2000 remediation projects. Readers can obtain copies by sending an e-mail message to: jgolter@fdic.gov, or to PHawry@Compuserve.com, or by calling 202-898-3924.

First Circle: Core Application Systems

In most large organizations, computer systems perform critical functions, including payroll, inventory management, accounting, accounts payable and receivable processing, and scheduling (of staff, production, or deliveries). The software used to run each of these processes may have been developed by an in-house programming staff or purchased off the shelf from a software firm, or it may represent a combination of off-the-shelf products and custom-developed applications.

If operations are to continue unaffected by the date change, many elements of a firm's core system need to be scrutinized, and either modified and tested or replaced. This process must be conducted on all important components of the system in a coordinated fashion so that the replacement of one part with a century-compliant version does not interfere with the functioning of another part with which it interfaces.

The important components include the system's hardware, its operating system software, and its application software (for example, the general ledger system). If any of these components is incapable of properly handling dates in the 21st century, it will probably have to be replaced with a newer, Year 2000-compatible version, but the upgrading of one component may require the upgrading of other components as well.

Programs will have to be examined line by line to look for places in which dates are used. Date-sensitive functions must be analyzed to verify that they will perform properly when dates from the 21st century are used. Every modification must be tested to ensure that the change does not inadvertently affect either another part of the program or one or more other programs on the system. The difficulty and cost of converting in-house applications will depend partly on how well those systems are documented.⁴

Second Circle: Networks, Workstations, PCs

The search for an institution's vulnerability to Year 2000 problems moves outward from the mainframe system to other data processing systems. Although the core functions of larger organizations usually reside on a mainframe computer, many important tasks may be performed on a network system, on a workstation, or on a stand-alone PC. A firm might be able to function without these systems for an extended period of time, but doing so would cause a great deal of disruption and inconvenience. Thus, part of a Year 2000 compliance

plan should include testing a network's hardware, software, and central data.

Third Circle: Third-Party Data Exchanges

The next circle of vulnerability involves exchanges of data with other entities. Even though an institution may have corrected all of its own data-processing systems, it may still be vulnerable if it is not prepared to read accurately the data it receives from other sources. One of the ways in which automation has developed over the years is by increasing the use of systems that exchange data between organizations. An example is Electronic Data Interchange (EDI) systems, in which a major customer and all of its suppliers exchange important data—from initiation of orders through invoicing and payment—without manual intervention. This development complicates the Year 2000 compliance process because all of the parties must agree on how the data will be modified. As each side of the data stream modifies and updates its data systems, it is important to coordinate and test the results with the counter-party.

Fourth Circle: Plant and Equipment

Although data-processing systems create the key areas of risk for many organizations, other places may also make an organization vulnerable to Year 2000 problems. Many important pieces of equipment, including telephone switchboards, security systems, HVAC, and elevators, may operate with embedded microprocessors that employ calendar functions and it is not always obvious that a particular piece of machinery has date functions incorporated in it. These must be tested to determine how they will behave when the century changes.

The potential failure of embedded microprocessors could expose some organizations to risks even greater than the ones faced from a malfunctioning data-processing system. Some manufacturing processes may rely on control systems that receive time-stamped data from sensors, compare the changes over time between readings, and either signal an operator that some procedure should begin or automatically make some adjustments to the process. If such control units incorrectly determine the sequence in which readings have occurred or incorrectly calculate the time between readings, they may fail to perform properly. The failure could disrupt the manufacturing process and

⁴"Documentation" refers to the text descriptions in clear English of the purpose and logic behind each section of computer code.

adversely affect a firm's ability to generate revenue. To determine in advance which machinery will be impaired, it is necessary to know how it was designed, and what the capabilities of the embedded microprocessors are.⁵

Fifth Circle: Business Partners

The next circle of vulnerability is located outside of the firm itself. All business organizations depend on suppliers to provide essential goods and services. If any of these suppliers has difficulty providing service, the organization's own operations could be adversely affected. Therefore, it is important for all firms to perform due diligence on their important suppliers to make sure that each has adequately addressed Year 2000 issues. Similarly, when a firm makes business planning and trade credit decisions, it should look at the vulnerability of its customers.

Sixth Circle: Macroeconomic Repercussions

The final circle of risk to which an organization is exposed because of date-change problems involves the economy as a whole. This is important to banks because, in general, a poorly performing economy will lead to a deterioration in the quality of a bank's loan portfolio and will therefore require an increase in loan-loss reserves.

The most immediate economic disruption from Year 2000 problems is the large cost that many firms will incur in fixing their systems to prepare for the next decade. This cost includes the opportunity cost of not being able to undertake other investments during the remaining years of the 20th century because of the need to focus resources on Year 2000 conversions.

As firms engage in "prudent" planning for the date change, their not being able to determine with any certainty which goods and services will be available uninterrupted after January 1, 2000, may lead them to build up inventories of raw materials and finished goods. This anticipatory stocking up is like the rush to buy batteries and various staples when a major storm is predicted. In these cases, simply the process of accumulating inventories and then reducing them back to normal, will cause some distortions in the overall level of economic activity.

Finally, economic disruption will be caused by the actual failures of some systems or enterprises. Initially, failures will be caused by the inability of individual organizations to fix critical systems in time. Between now and the Year 2000 some marginal firms may choose not to incur the cost of converting a system and may subsequently go out of business. One analyst predicts that Year 2000 problems will create a 1 percent level of risk that any given Fortune 500 corporation fails, a 3 percent risk of failure for any given small firm (less than 1,000 employees), and a 5 – 7 percent risk for any given mid-size firm (1,000 – 10,000 employees). The analyst notes: "Mid-sized corporations . . . have historically shown a distressing tendency to utilize quite a lot of software, but to be only marginally competent in how they build and maintain the software. . . . There are about 30,000 companies in the 'mid-size' range in the United States, and a 5% to 7% business failure rate would mean that from 1500 to about 2100 companies might close or file for bankruptcy as a result of the year 2000 problem. This is a significant number and it is an open question as to whether the impact of the year 2000 problem is severe enough to trigger a recession."⁶

Another analyst, Dr. Edward Yardeni, Chief Economist at Deutsche Morgan Grenfell, has written extensively about the Year 2000 and its potential effects on the world economy.⁷ Based on his analysis of the remediation efforts to date of the federal government, the electric utility industry, the transportation industry and other components of the economy, Dr. Yardeni has estimated that "there is a 40% chance of a global recession during 2000 as severe as the 1973-74 downturn."⁸

The magnitude of the economic effects of the Year 2000 will be determined by how successfully each firm, each government entity, and each nonprofit organization addresses the problems it faces. As a whole, the banking industry has demonstrated a greater awareness of the problem than most other sectors of society, so bankers are in a good position to inform their customers and other members of the community about the nature and urgency of the problem.

ASSESSING AND MITIGATING RISK IN COMMERCIAL LOAN PORTFOLIOS

The earnings of a lending institution could be significantly reduced if the bank's commercial customers were delinquent or had to default because of Year 2000 problems within their own systems or within the system of their important customers and/or suppliers.

⁵A good source of additional information about Year 2000 risks within embedded technology is the Web site of the (British) Institute of Electrical Engineers (www.iee.org.uk/2000risk/).

⁶Jones (1996), 38.

⁷Dr. Yardeni's various articles on the subject are all available on his Web site at www.yardeni.com/cyber.html.

⁸*The Y2K Reporter* #11, January 5, 1998.

Banks should therefore incorporate analyses of their customers' Year 2000 risks into their loan review process.

When a thorough assessment gives the lender confidence in the borrower's ability to handle its Year 2000 challenges, both parties can benefit. Firms that complete extensive Year 2000 remediation projects will probably find that after the date change, even though they may experience disruptions that impair their cash flows, these disruptions represent manageable, temporary events. Bank loan officers who have been monitoring those remediation projects will be better able to recognize when a firm's problems are temporary and thus when the firm deserves credit extensions.

Managing the risks in a commercial loan portfolio involves setting up a program to evaluate four aspects of each loan. First, if the borrower became delinquent or were to default how seriously would the bank be affected. Second, how seriously could Year 2000 problems affect the borrower. Third, how well is the borrower dealing with these risks. Finally, how can the bank best minimize its exposure to Year 2000 risks. In establishing a program to manage these risks in its commercial loan portfolio a bank may wish to use the following elements as a starting point: planning and strategy, assessment of portfolio risk, customer assessment, tools and procedures, and integration into the existing credit review process.⁹

Initial Planning and Strategy

Senior management at banks should consider developing an approach for addressing the Year 2000 risks within its loan portfolio. The first step in addressing these risks is to develop a strategy. Then plans will have to be developed for implementing the strategy. (Because time is the scarcest resource in all Year 2000 activities, many of the necessary activities may have to be performed simultaneously.) The strategic questions that should be considered include the following:

- Should the bank take a defensive posture at the risk of alienating some long-term customers?
- How will the bank deal with customers who do not appear to be adequately addressing their Year 2000 challenges?

- Should the bank view current and new customers' needs to finance Year 2000 conversion projects as an opportunity to increase lending?
- Under what circumstances will the bank provide additional working capital to a borrower whose cash flows have been disrupted by problems related to the Year 2000?
- How will the bank evaluate the Year 2000 risks within its loan portfolio? How will individual loans be prioritized for Year 2000 assessments?
- How will the bank monitor and track its exposure to Year 2000-related credit-quality risks?
- How much assistance will the bank give to its customers in dealing with their Year 2000 projects?
- Will the bank require that Year 2000 compliance be written into covenants for new and renewing credits?
- What information about a commercial customer's Year 2000 readiness will be communicated to third parties, such as partners in a loan participation, credit bureaus, or other potential lenders?
- How will the commercial loan department's Year 2000 project be integrated with the bank's other Year 2000 projects?
- How much detail will the bank provide to commercial customers and other business partners who, as part of their own due diligence efforts, inquire about the bank's Year 2000 readiness?

Personnel from several areas of the bank will need to be involved in the early planning phases. The board of directors should approve the final action plan, oversee its implementation, and ensure that adequate resources are provided. Senior management needs to sponsor and develop the strategic plan and be responsible for ensuring its successful implementation. Commercial loan officers will communicate the bank's policies to its customers. They will also obtain the information that will be used to assess the customers' Year 2000 readiness. The loan assessments will be incorporated into the credit approval and loan review process. The Loan Review and Credit Departments will need to develop the procedures by which Year 2000 Review Department will also want to help plan for the prioritizing of credits in the loan portfolio for risk analysis. The legal staff (or outside counsel) and the Risk Management Committee will need to review the loan agreements to determine whether additional

⁹This article does not attempt to provide an exhaustive list of all the programs a bank may undertake to manage the Year 2000 risks in its loan portfolio. Each bank will need to develop a program that is appropriate for the unique Year 2000 characteristics of its customers.

language or covenants should be added to cover Year 2000 concerns.

The Data Processing Department may be asked to describe its Year 2000 project to the other parties mentioned above, to help them understand the scope and complexity of some of the issues borrowers will be facing and to give the loan officers a better understanding of the information the customers will provide. In some cases it may prove useful for data-processing personnel to accompany loan officers to meetings with customers about Year 2000 issues. Other internal parties that may also be involved in developing and implementing a risk management project include Cash Management, Corporate Trust, Audit and Marketing.

At the end of the initial planning process, a written program that describes not only policies and procedures but also each division's role in implementing the plan should be presented to the board of directors for approval.

Assessment of Portfolio Risk

After completing the initial planning, commercial banks will need to develop a process for evaluating the nature and scope of the Year 2000 risks in their loan portfolios. They will also need to establish priorities for mitigating those risks. Each loan portfolio is unique and contains a different mix of industries, loan structures, collateral, and loan sizes. Moreover, some commercial customers have sophisticated in-house systems and maintain direct control over the majority of Year 2000-affected processes, whereas others are highly dependent on the technology of third parties, such as suppliers or distributors. Because lenders are unlikely to have the resources, time or training to audit the Year 2000 compliance of every commercial customer, they must develop some means of identifying the greatest risks and addressing them efficiently while engaging their other customers in less-extensive forms of monitoring.

Institutions may choose to analyze the riskiness of each lending relationship through a two-step process. The first step would involve classifying the portfolio according to the risks posed by different types of customers; increasingly-intensive levels of monitoring requirements could then be applied to the classes of loans that present the greatest risk to the institution. In the second step, the individual efforts of the customers in each stratum would be evaluated so that entities that have not taken adequate measures to deal with the Year 2000 challenges they face could be identified.

Loans have four major characteristics that contribute to the degree and nature of the potential Year 2000 risks they pose for the lender. These four risk categories are the type of business, the relative size of the credit, the structure of the loan, and the type of collateral. A particular customer may contribute risk in all four categories. Some banks may choose to distill this process of measuring risk into a scoring system to rank the risks presented by each borrower. Others may choose to develop a system in which borrowers with similar risk profiles are grouped together. The statistical analysis and sampling approaches for risk monitoring are discussed later in this article.

Line of business risk. Because of the businesses some borrowers are in, they may not face much direct risk from Year 2000 problems. Other borrowers that rely on sophisticated automation for producing, delivering, or getting paid for their products and services, will face much greater risk. For example, it is difficult to imagine how a barber might be put out of business because of Year 2000 difficulties. On the other hand, a medical practice—even a small one—will have many more sources of vulnerability: a doctor's practice could be severely threatened if his or her switchboard (or an answering service's switchboard) failed for an extended period, or if access to on-line patient records was lost, or if sophisticated diagnostic or testing equipment malfunctioned and produced inaccurate readings, raising issues of liability, or if billing systems that are linked to medical insurance companies ceased to work. To some extent, determining the risks posed by certain types of businesses may become an iterative process. As more is learned about the problems uncovered and being addressed by one borrower, the risks facing other borrowers in the same industry may become clearer.

Proportionality risk. The larger a credit facility is, the greater the bank's potential exposure. Hence, special attention should be paid to the larger credits in the loan portfolio. Of course, the bank's potential exposure from a customer would include unused lines of credit, outstanding letters of credit, guarantees made on other credits, any portions of a loan that were sold with recourse in a participation agreement, and any other exposures the bank might have from its dealings with the customer, including those that could arise from derivative contracts created on the customer's behalf.

Credit structure risk. The structure of a loan may affect its riskiness. Loans that mature before the Year 2000 will impose risk only if the borrower anticipates rolling over the credit. Amortizing loans may represent less risk than unsecured lines of credit from which customers can draw funds at will.

Collateral valuation risk. Collateralized loans may lose value if the collateral itself becomes impaired by Year 2000 problems. For example, some sophisticated production equipment may malfunction after the century changes because of embedded noncompliant microchips that operate or control the machinery. Should the equipment fail and be difficult or impossible to repair, the borrower could have difficulty maintaining production and making payments on any loans. In this case, having a lien on collateral—the broken equipment—would not bring the lender any relief, but defaulting loans that were collateralized with real estate or government securities would be less likely to impose large losses on the bank.

The ultimate purpose of the portfolio risk analysis is to develop the bank's program of reviewing and dealing with its individual customers' Year 2000 projects. For example, a bank may define four regimes of increasingly intensive review. The minimal regime might involve corresponding with a borrower (or rely on a questionnaire) to determine if the borrower is aware of Year 2000 issues and has a plan in place. The most intensive regime might involve on-site interviews between the borrower's Year 2000 project manager and the bank's loan officer (accompanied by someone with Year 2000 expertise, perhaps from the bank's Year 2000 project team) and a request for regular progress reports. A description of each regime would specify how the initial customer contact would take place, what information would be received from the customer, and how the responses might be evaluated. On the basis of the information reviewed, different follow-up programs could be defined for customers in each program.

Risk management targets could be established. For example, a bank may decide that customers whose credits aggregate to at least 40 percent of total borrowings would receive the most intensive monitoring, and that no more than 15 percent of aggregate borrowings would be subject to the least-intensive regime. Similar goals could be established for the other risk categories. As customers are assigned to the appropriate monitoring program, the bank is then able to determine whether it is adequately covering its identifiable risks.

Assessments of Customers

A bank's Year 2000 awareness effort should include all commercial customers. Thus, borrowers will be aware of the risks they face and will understand the activities they must engage in to reduce those risks. At a minimum, customers who were identified during the analysis of portfolio risk as contributing the greatest risks to the bank should be required to submit descrip-

tions of their Year 2000 project remediation plans. The bank can then assess the reasonableness of the plans and the progress being made towards completing the project.

A customer's overall viability at the turn of the millennium can be affected by many factors, and lenders cannot expect to become as knowledgeable as expert consultants on Year 2000 project management. In many cases, loan officers, therefore, will need access to expertise, whether from within the Year 2000 compliance team in the bank's Data Processing Department or from outside consultants. Ultimately, however, lenders will need to become familiar enough with the issues involved in Year 2000 project management to understand the assessments being made by those experts.

Lenders need to determine whether their customers have the commitment and skills to ensure that critical processes will function and contingency plans have been developed. Lenders need to be reasonably assured that Year 2000 risk is understood and is managed as a significant project within the client organization. The characteristics of a well-executed Year 2000 compliance project follow.

Sponsorship: The Year 2000 project is sponsored by the CEO or the board of directors and a senior, experienced project manager is assigned to it and is accountable. *Scope:* The project encompasses all potential areas of risk, not just the data-processing systems; the assessment extends to infrastructure, equipment and external relationships. *Priorities:* The organization has prioritized key areas of risk and remediation plans are scheduled to address all mission-critical areas. Areas that may begin to fail earlier than others are scheduled for prompt remediation. The first step in this process is to inventory all systems and equipment that may be at risk—and any large organization that has not yet begun to do this by the time the present article is published should be considered a high risk. *Plan:* The borrower has a written plan for addressing Year 2000 problems, and it includes a reasonable timetable for completing important milestones; the timetable must leave sufficient time to test the programming changes that are implemented, and allow sufficient time to accommodate unexpected problems. *Resources:* The project has an adequate budget and sufficient numbers of dedicated employees are assigned to the effort; if appropriate, the company has engaged consulting services to assist with the project. The organization's participation in Year 2000 user groups would be a good sign. *Status:* The borrower's project has achieved a reasonable degree of completion, and in any case has not

fallen behind schedule.¹⁰ *Vendor compliance:* The customer understands its reliance on externally controlled processes or equipment and is taking steps to confirm that the external organization will be compliant. For example, if the borrower is a manufacturer, vendors may be asked to test and warrant that the equipment that controls the production process will not fail with the date change. Whenever possible, a vendor's representations should be confirmed by independent third parties. In the case of critical equipment where the possibility exists that it could malfunction by operating in a manner that appears normal while generating inaccurate readings, plans should be made to conduct tests after the date changes. *Coordination with Business Partners:* The firm has engaged in a dialogue with its customers and suppliers, has performed due diligence on key partners and developed contingency plans in case any of them suffers serious Year 2000 disruptions. In cases in which the organization exchanges electronic data with other entities, agreements have been reached concerning new standards and interfaces. Plans have been made for testing interfirm exchanges of data early enough in advance of the date change to allow time to correct any problems that emerge during testing. *Contingency plans:* The client has plans for minimizing the consequences of any date-related disruption. For example, what will a hospital do if it determines that certain pieces of equipment are malfunctioning? Do alternative solutions or products exist? Have they been contracted for or leased ahead of time? Does the hospital have an alternative communications plan in place if the telephone system fails to operate?

For the customers representing the bank's greatest exposure, loan officers will want to evaluate the organizations' project plans and monitor their progress in achieving their goals. The May 5th FFIEC statement presents a useful framework for assessing an organiza-

tion's Year 2000 project. The statement includes a description of the five phases that a bank needs to complete in order to address the Year 2000 challenge properly. These phases are Awareness, Assessment, Renovation, Validation and Implementation. In using this framework to track the progress of an organization, the bank can ask the client to provide target dates by which 25 percent, 50 percent, 75 percent, and 100 percent of the critical systems will be renovated, validated, and implemented. Plans must include deadlines that are reasonable, given the resources being used, but that at the same time provide enough slack to accommodate any unexpected problems that may emerge. Progress toward meeting deadlines can then be monitored at the appropriate times. Other aspects of the borrower's Year 2000 plan should also be evaluated. The bank should determine if the borrower's plan includes assessment and repair of internal infrastructure (such as HVAC and elevators); the extent to which the firm has performed due diligence on key suppliers and business partners; whether contingency plans exist and are reasonable, and whether Year 2000 planning has been integrated with the firm's business strategies, including the development and introduction of new products, and mergers and acquisitions.

Tools for Monitoring and Reducing Risk

Loan officers may find different tools to be especially useful in managing the bank's Year 2000 risks. These are customer awareness campaigns, customer questionnaires, and statistical analysis and sampling.

Customer awareness and education campaigns. Unless a problem is understood and taken seriously customers will not adequately address it. Unfortunately, surveys in late 1997 indicate that senior management of many organizations have yet to understand the complexities and enterprise-wide effects the "millennium bug" can have on their organizations.¹¹ Financial institutions should ensure that their customers understand the issues surrounding Year 2000, and the actions they might take to minimize their exposure. Year 2000 presents an opportunity for financial institutions to provide a service by bringing attention, focus, and external discipline to their customers' remediation projects.

Awareness campaigns can take many forms. Some institutions might write or reproduce articles on the topic and send these to their customers. Other institutions might mount vendor fairs and bring together a variety of experts, ranging from consulting companies to technology tools vendors to provide their customers with a range of sources of information. Still other insti-

¹⁰The FFIEC (1997) strongly encourages financial institutions to have completed an assessment of their Year 2000 project by the end of third quarter 1997, and to have the programming changes for all critical systems made by December 31, 1998. The entire year of 1999 to then be devoted to testing. Similar time frames are appropriate for borrowers with large data-processing needs.

¹¹"According to survey findings released last week by Gartner Group Inc., 40 percent of the 2,300 companies and government organizations in 17 countries are still at the initial awareness and assessment phase." (*InformationWeek* (1997)). "Cap Gemini America, which offers Year 2000 remediation services, found only 16 percent of Fortune 500 companies surveyed have begun to implement a full-fledged strategy to become Year 2000 compliant, and only 24 percent have a detailed plan in place. Some companies have not begun any work at all." (Patrizio (1997).) "Very few of the 2,000 midsize retailers in the United States are ready for the Year 2000 according to a study released last week by the National Retail Federation." (*InformationWeek* (1997).)

tutions might mount seminars on Year 2000 assessment and remediation strategies and incorporate the financial institutions' own expectations relative to their lending policies and monitoring practices. In some cities, Year 2000 users' groups have been formed. Because the financial-services industry was one of the first to become aware of the problem, some banks have been early participants in these groups. However, many users' groups have limited participation to data-processing personnel. Lending or credit officers who wish to join these meetings should ask if their participation would be welcome or if their presence might inhibit discussion.

If the institution has already determined that it will alter its lending and credit policies, conduct Year 2000 audits, or require self-assessments from its borrowers, these new policies can be introduced in the awareness campaign. It is essential to make all customers clearly aware of the Year 2000 issues as soon as possible, so they can quickly plan and implement compliance programs.

Customer questionnaires. Probably the single most effective tool that the financial institution might wish to use to determine the degree of risk within the loan portfolio is customer completion of a self-assessment of its Year 2000 readiness and planning. A fairly comprehensive and well-designed questionnaire will yield important information and clearly indicate the level of risk exposure and next steps that might be necessary to reduce risks. Many major corporations now require their key suppliers to answer such questionnaires to certify their compliance with Year 2000 before they will renew contracts.¹² Some insurance companies are now developing specialty policies for business interruption from Year 2000 problems with primary underwriting data generated from customer self-assessment questionnaires.¹³ Lenders should determine when it would be appropriate to incorporate this type of assurance into the overall credit review of a customer. Many of the Year 2000 questionnaires that are currently in use can be modified to reflect the lender's needs (see Appendix). Ideally, for the questionnaire to support the lender's review process, it should allow quantitative analysis (that is, should provide scoring data that can be weighted and/or evaluated in a risk assessment).

There are different approaches a financial institution can take to using questionnaires. The institution can require customers to complete the questionnaire immediately or at the point of next loan renewal, or it can take a softer approach and promote the questionnaire as a tool that is to be used primarily for the benefit of the customer and is not tied directly to a lending policy. In either case, once the customer has produced a self-assessment of Year 2000 readiness, it will probably have a better understanding of the scope of the problem and the efforts needed to remedy any shortcomings.

If the financial institution chooses to use questionnaires, it will have to determine which of the completed forms it wishes to review and how it will respond to the information contained in them. This decision would evolve from the program that was developed during the assessment of portfolio risk.

Statistical analysis and sampling. Because the time and resources available for addressing Year 2000 credit concerns are limited, banks may find it more efficient to use statistical analysis or sampling, or both. Statistical analysis of the overall portfolio will help with the portfolio assessment; sampling may help the bank estimate the initial state of readiness of different segments of the portfolio.

The purpose of the statistical analysis is to segment the loan portfolio into potential risk categories as described in the section on assessing portfolio risk. The first step is to determine which characteristics may be relevant in contributing Year 2000 risk to the bank. The variables that would be appropriate are business category (such as SIC code) and specific product lines; type of collateral; credit structure; projected outstanding balances on 12/31/99; current outstanding balances and line commitments; the risk or credit scores already associated with that credit, and liquidity of the borrower; and if available, the results of the initial Year 2000 questionnaires.

The next step is to determine how the loan portfolio is distributed across each of these characteristics and then to plan accordingly. For example, if a large proportion of the loan portfolio is associated with a particular type of business (for example, retailing, manufacturing, technical services), specialized review procedures for that industry can be developed.

Important cross-tabulations should also be analyzed. For example, what percentage of the estimated 12/31/99 portfolio is composed of loans to businesses with poor liquidity secured by equipment that may be

¹²Hoffman (1997).

¹³For example, American International Companies' Millennium Insurance Policy.

impaired by embedded technology that is not Year 2000-ready?

When a bank wants to get a sense of how well prepared various types of borrowers are while it is developing initial plans and strategies for addressing Year 2000 credit risks, sampling may be useful. Surveying and compiling the responses of all borrowers could take considerable time and effort, so banks may choose first to survey a smaller sample of various categories of borrowers. (Banks that have not had much experience applying sampling techniques may wish to hire a consultant to help design the sample and interpret the results.) The results of the survey may help the bank determine how extensive its public awareness campaign needs to be and how much time and how many resources it should allocate to monitoring customers' Year 2000 preparations.¹⁴

Different banks will use statistical analysis and sampling in different ways. Some banks may choose to obtain information about each customer's Year 2000 project plans (from a written questionnaire, telephone contact, or on-site visits). Other banks may initially canvas a sample of borrowers to identify characteristics that may indicate risks. Still other banks may choose to build their models of portfolio-level risk before receiving any information from borrowers in order to save time in the early (analysis) stage and will then direct most of their attention to only the most critical borrowers.

Integration into Loan Review System

Banks will have to develop a system for incorporating the information they receive about each customer's Year 2000 projects into the existing loan review system. In addition, some banks may choose to develop systems that track the overall level of Year 2000 risk in the loan portfolio. Decisions that have to be made involve, among other things, timing, verification, standards, measurement of success, and changes to the loan review process.

Timing. Will the bank require that (some) borrowers report on Year 2000 progress more often than they are currently required to report financial data? Will the loan officer—on the basis of an assessment of the quality of the borrower's plans and its progress to date in completing the plan—establish a separate review schedule for each customer?

Verification. Will the bank require independent assessment of (some) borrowers' Year 2000 readiness from an accounting firm or other independent analyst? Will the bank want to contact customers and/or suppli-

ers of the borrower to verify that they have been coordinating on Year 2000 issues with the borrower? To the extent that the bank itself exchanges electronic data with a corporate customer, loan officers should help facilitate the interaction between the two organizations' data-processing staffs and should stay informed about any difficulties that emerge during tests of the new formats.

Standards. What will the institution consider minimal acceptable activity on the part of borrowers for the bank to retain confidence in the borrower? How will these standards be communicated to borrowers? Will new covenants be added to the loan documentation?

Measuring the success of a borrower's program. If a borrower experiences some disruption early in the Year 2000 caused either by the malfunctioning of internal systems or by such external factors as the inability of suppliers to deliver goods or services, how will the bank estimate the time required to recover and the obstacle the borrower faces in regaining normal cash flows? If such borrowers want to draw down or increase outstanding credit lines, how will the bank analyze these cases?

Loan review. How will the bank incorporate information about a firm's Year 2000 readiness into its credit and loan review decisions? How often will the borrower's progress toward completing its Year 2000 project plan be tracked and reevaluated? How quickly and firmly will the bank deal with customers that do not have adequate or realistic remediation plans or that have fallen far behind in implementing those plans?

CONCLUSION

The Year 2000 problem is unprecedented. Although simple in origin, it can have serious consequences. For many borrowers, managing a remediation plan is complex, and commercial customers who do not properly handle their Year 2000 projects can present banks with credit risks. To manage this type of risk effectively, a bank will have to devote time and resources to developing and implementing an action plan. This task is made more difficult by the need for loan officers to become more knowledgeable about the technical and operational aspects of their customers' business than they normally have to be. However, if the bank successfully implements a plan, it will have not only avoided large credit losses but also strengthened its relationship with its best customers.

¹⁴For more information on how to create and measure a sample, see Cowan (1997).

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APPENDIX

Sources of Additional Information

WEB SITES

The World Wide Web on the Internet includes many sites that maintain extensive information about Year 2000 issues.

Government Entities:

FDIC: The FDIC has plans to include Year 2000 information on its Web site. The material will be accessible from the FDIC homepage at: www.fdic.gov.

FFIEC: The FFIEC Web site includes the Year 2000 guidances that the Council has issued, Congressional testimony of bank regulators, bank trade associations, and links to other Year 2000 Web sites. One link of potential interest to commercial loan officers is the U.S. General Accounting Office's Year 2000 Assessment Guide. This document outlines the steps that organizations should follow as they manage their Year 2000 remediation project. The efforts of commercial customers can be compared to the practices described in this document. www.ffiec.gov/y2k/default.htm.

Federal Reserve Board: The FRB site includes copies of testimony and speeches of agency officials, information on testing PCs for Year 2000 problems. www.federalreserve.gov/y2k/.

General Services Administration: The GSA maintains a comprehensive Year 2000 Information Directory with links to other government agencies, vendors, and news articles. www.itpolicy.gas.gov/mks/yr2000/y201toc.

Trade Associations:

Institute of Electrical Engineers: This British association has some detailed information about the problems associated with equipment built with microchips that may malfunction when the calendar changes. www.iee.org.uk/2000risk/.

Information Technology Association of America: The ITAA has a program for certifying that organizations are following best practices in dealing with Year 2000 issues. The Web site has more information about this program, including a way to order the questionnaire upon which certification decisions are based (at the time of this writing, there is an initial fee of \$250 to receive the questionnaire and a very substantial fee for applying for certification). The Web site also contains an archive of past issues of the ITAA's electronic newsletter on Year 2000 issues, a page from which to order books about the Year 2000, and additional useful information. www.ita.org/year2000.htm.

RMA: The Association of Lending and Credit Risk Professionals: The RMA site has a Year 2000 area which includes a questionnaire that loan officers can use as part of their Year 2000 assessment of borrowers. www.rmahq.org.

Society of Information Managers: SIM sponsors a Web site upon which the Year 2000 Best Practices Discussion Group takes place. The Web site also includes a page from which a large number of Year 2000-related books can be ordered. www.year2000.unt.edu.

Private Firms:

ASB Bank: This New Zealand institution has some Year 2000 information on its Web site, including the text of a letter that it has sent to all of its customers discussing Year 2000 concerns. www.year2000.co.nz/y2kabs01.htm.

BankBoston: Among U.S. financial institutions, BankBoston has been one of the most public in its discussions of Year 2000 issues. www.bankboston.com/todya/about/y2k.html.

Gartner Group: The Gartner Group provides consulting and advisory services on technology matters to its clients, which include the FDIC and many financial institutions. They have con-

ducted a great deal of research and analysis on the Year 2000 problem. Occasionally, specific Year 2000-related materials are made available to the general public on their Web site. www.gartner16.gartnerweb.com/public/static/home.html.

Market Partners: Market Partners was established to assist banks in their Year 2000 projects. Their Web site is open to the public and includes breaking news stories related to Year 2000 and the banking community and an extensive list of links to related Web sites (including one called *H. Elliot's Mother of All Year 2000 Links Page*). www.marketpartners.com.

Edward Yardeni: Edward Yardeni, Chief Economist at Deutsche Morgan Grenfell, sponsors Dr. Edward Yardeni's Economic Network, a Web site of general interest to the banking community. Within the Web site is the Center for Cyber Economics from which the public has access to an archive of Dr. Yardeni's writings on Year 2000, and an extensive listing of related Web sites, including several that discuss legal issues. The site also contains a brief questionnaire that can be used for assessing the Year 2000 readiness of other organizations. www.yardeni.com.

Year 2000 Information Center: This site is the home of Peter de Jager, perhaps the Paul Revere of the Year 2000. The site includes links to various solution providers, local user groups, and to a daily listing of articles that have appeared in the press about Year 2000. www.year2000.com.

Electronic Newsletters:

Several organizations produce newsletters about Year 2000 issues that are delivered via e-mail. The ones listed here are free to the public.

Cutter Consortium: The Cutter Consortium produces a weekly newsletter aimed at the CIO and CEO of corporations. www.cutter.com/consortium.

ITAA: The ITAA's weekly newsletter has an emphasis on issues relating to government policies. It includes a listing of upcoming Year 2000 conferences and seminars. www.ita.org/year2000.htm.

Year 2000 Information Center: This newsletter includes the URLs for several recent press reports on Year 2000 topics that are available online. www.year2000.com.

BOOKS

Year 2000 Problem: Strategies and Solutions from the Fortune 100

Leon Kappelman, Contributing Editor
International Thomson Computer Press.

Leon Kappelman, a professor at the University of North Texas, is the Co-Chair of the Society of Information Managers' Year 2000 Task Force. Information about the book can be found at www.year2000.unt.edu/book/main.htm. It can be ordered by calling (512) 321-9652 or 1-888-999-2665. This Web site also has links to a long list of additional books about the Year 2000 problem.