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Liquidity Risk Management

A Practitioner's Perspective

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CHAPTER 1

Introduction

Shyam Venkat and Stephen Baird[1]

The global financial crisis began as fears over credit losses and counterparty insolvency eroded market confidence and quickly led to a full-fledged liquidity crisis. As early as August 2007, institutions were seeing a fundamental shift in the liquidity of markets, well before the depth of the mortgage crisis was understood. Today, over eight years later, we stand in the midst of a risk management and regulatory transformation that is touching every aspect of how financial institutions manage their risks and is far from complete. Liquidity risk—one among a very long list of worries for banks, asset managers, regulators, and customers—nevertheless stands apart as it addresses the lifeblood of an institution and liquidity can dry up suddenly if not properly managed. While the credit profile of a loan portfolio can take months or even years to deteriorate, liquidity can disappear in a matter of hours. Liquidity is unpredictable, difficult to measure, and often opaque. In a crisis, market participants are more likely to rely on the media and the rumor mill rather than earnings releases to evaluate the risk of providing liquidity to a trading partner.

Despite these challenges, or perhaps because of them, and also due to the excess liquidity in the financial markets during much of the 1990s and early 2000s, liquidity risk has in many respects held a lower position on the risk management and regulatory agenda than many other key risk types—particularly credit, market, and overall capital adequacy. As described in the chapters that follow, we believe that industry and regulatory focus is shifting rapidly to liquidity risk, and that banks will need to significantly upgrade their capabilities over the next several years. These improvements will touch every aspect of liquidity risk management—framework design, process management and oversight, and technology capabilities all will need to be upgraded to meet both the demands of the marketplace as well as regulatory expectations. Meeting this

[1]Shyam Venkat is a principal in PwC's New York Office, and Stephen Baird is a director in PwC's Chicago office.

challenge successfully will require an agenda, and the principal objective of this book is to suggest the details and approaches to meeting that agenda.

A PRACTITIONER'S PERSPECTIVE

The subtitle of this book is "A Practitioner's Perspective." What is a practitioner's perspective? In our view, practitioners—treasurers and risk managers charged with actually managing and monitoring the bank's liquidity risk—benefit most from information that:

- **Reflects industry practices:** The practitioners seek to understand how liquidity risk is managed outside of their institution. Where are other firms ahead of them? Where are they leading the pack?
- **Brings a regulatory perspective:** More than ever, the regulatory agenda is shaping the risk agenda. In this environment, understanding what regulators expect—both today and in the future—is an important aspect of building the most effective risk management framework. Arguably though, a well-conceived, robust, and effectively implemented set of liquidity risk management capabilities will generally align with, and even inform, supervisory expectations.
- **Is forward-looking:** The practitioner not only lives in the world of what is possible, but also understands the need to keep moving forward. Understanding emerging trends in liquidity risk management is an important aspect for practitioners.

We also note what this book is not—a theoretical view of how liquidity risk management should be performed in a world of costless analytics and unlimited access to real-time data across the enterprise. We leave that perspective to academia.

OUTLINE OF THE BOOK

This book is organized into three sections. The first section, "Measuring and Managing Liquidity Risk," lays out the building blocks of a liquidity risk program in a series of chapters dedicated to key topics. We begin with Chapter 2, "A New Era of Liquidity Risk Management," by outlining a set of leading practices that can be garnered from each of the chapters in this book. Our chapters—addressing stress testing, intraday liquidity risk management, collateral management, early warning indicators, contingency funding planning, liquidity risk information systems, and the liquidity implications of recovery and resolution planning—are designed to assist

practitioners in honing their knowledge of these areas and creating a forward-looking improvement agenda.

The second section, "The Regulatory Environment of Liquidity Risk Supervision," describes recent and upcoming developments on the all-important regulatory front. This landscape includes a focus not only on recent standards in liquidity proposed by the Basel Committee of Banking Supervisors (referred to as Basel III) but other developments in the areas of stress testing and reporting.

The third and final section, "Optimizing Business Practices," considers how this transformation of liquidity risk management practices will impact business activities and how banks should respond. Clearly, with liquidity risk receiving more attention than ever before, sticky money will be more valuable than hot money. The question is: How will banks meet the challenges of aligning their business activities—through product design, funds transfer pricing, management incentives, and other mechanisms—to reflect this new priority?

CORE THEMES

Before we delve into the details, we highlight three core themes that you will see throughout the chapters in this book. These themes represent the fundamental characteristics of today's liquidity risk environment and where we see the future direction. As you read these chapters, please keep an eye out for:

- **The intertwining of the regulatory and management agendas.** The importance of the regulatory agenda in driving liquidity risk transformation is, and will continue to be, a key feature of liquidity risk management. While this agenda is driving banks to improve their practices, practitioners should remain mindful of the importance of an internal management-driven agenda aimed at continuous improvement of the firm's capabilities.
- **The challenge of automation.** In many respects, the challenge of raising the liquidity risk management bar will be less about measurement frameworks and policies and more about implementing a robust set of capabilities that will be underpinned both by effective governance and technology-enabled solutions. Building an infrastructure that captures, stores, and transforms data in an automated and controlled fashion may be the most daunting challenge.
- **The drive to integration.** Despite all of the advances in risk management since the financial crisis, banks' risk management frameworks

remain largely fragmented, with the management of various risks often being addressed in siloed fashion, and with risk management processes themselves often being delinked from other business activities such as strategic planning, incentives, and profitability measurement. Integrating liquidity considerations into how the bank is run will be a key priority.

ACKNOWLEDGMENTS

As this book is a practitioner's guide, we thought it useful to have our team of practitioners that specialize in the risk management arena share their perspectives and insights. We would like to acknowledge not only these contributors, but many dedicated current and former PwC professionals that worked behind the scenes to make this publication happen. They include: Vishal Arora, Lee Bachouros, Michelle Berman, Jon Borer, Rahul Dawra, Amiya Dharmadhikari, Jaime Garza, William Gibbons, Alison Gilmore, Mayur Java, Shahbaz Junani, Emily Lam, Fleur Meijs, Agatha Pontiki, Manan Shah, Dan Weiss, Jon Paul Wynne, Scott Yocum, and Yuanyuan (Tania) Yue.

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PART

One

Measuring and Managing Liquidity Risk

CHAPTER 2

A New Era of Liquidity Risk Management

Shyam Venkat[1]

INTRODUCTION

Liquidity risk management is a core competency for all types of financial institutions, from "sell-side" firms, like banks, to "buy-side" institutions such as insurance companies. Banks typically engage in maturity transformation by funding themselves with deposits and other short-term liabilities and investing in assets with longer-dated maturities, while continuing to meet liability obligations as they come due. Capital markets trading businesses provide market liquidity in various asset classes by facilitating order flow between buyers and sellers of financial assets and maintaining inventory through positions using their firms' own capital.

The period from the mid-1990s to the mid-2000s saw relatively few advancements in the discipline of liquidity risk management, even as approaches for measuring and managing credit, market, and operational risks were gaining in sophistication and infrastructure. The Asian currency contagion of the late 1990s, dotcom bust in early 2000, terrorist attacks of 9/11, and subsequent commencement of two major wars in Iraq and Afghanistan did little to heighten concerns outside of regulatory circles around liquidity risk management or spur significant advances in the risk management discipline. Robust global economic growth, fueled by easy credit, looked poised to remain the new normal as industry insiders, pundits, and regulators touted the benefits of the "great moderation," pushing concerns for liquidity risk into the background.

The global financial crisis began in mid-2007, spurred on by the onset of several liquidity events, and brought on dramatic and rapid change. The dramatic increase in systemic risk made almost all financial institutions—even

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those few leading firms that had upgraded their liquidity risk management practices and infrastructure over the preceding decade and made some astute market calls—unprepared for the crisis. Company treasurers and their treasury functions, tasked with managing enterprise funding and liquidity, were now immediately center stage under the spotlight, and worked feverishly to help keep their institutions afloat even as financial markets and peer institutions faltered around them. Suddenly, client cash and secured financing, long considered safe sources of funding, were evaporating; deposits, even those guaranteed by the Federal Deposit Insurance Corporation (FDIC), were being withdrawn, giving rise to concerns of runs on banks. Previously liquid asset markets with readily transactable quotes experienced significant disruptions as market makers and buy-side customers were unsure how far the contagion would spread and became risk adverse. Consequently, the ensuing erosion of balance sheet strength and earnings power among financial services firms brought forth a renewed focus on the importance of liquidity risk management. The raft of new rules and regulations that shortly followed the financial crisis also prompted financial firms, particularly banks and capital markets institutions, to significantly enhance their capital and liquidity positions and related risk management capabilities. Much of the market scrutiny in the United States, United Kingdom, and Europe directed banks and other financial services firms to concentrate on de-risking balance sheets and enhancing capital management capabilities with respect to risk governance, stress testing, capital planning, and capital actions.

In the aftermath of the crisis, liquidity risk management practices have continued to evolve and the pace of that change has quickened as regulatory guidance continues to raise the standards on what are considered "strong" capabilities. Given the relatively early stage and continuing evolution of capabilities in this area, some of these practices may even be viewed as "leading" in nature. The discussion in this chapter on leading practices for liquidity risk management is, by no means, exhaustive; we acknowledge preemptively the contrary to be true. Moreover, there are several additional sources of excellent guidance on this topic that have been issued by various experts, industry practitioners, supervisory agencies, and other regulatory regimes around the world.

The focus of the compendium of fundamental and leading practices summarized in this chapter is more methodological and practical, rather than the principles-based guidance that is often offered by supervisors and regulators. Accordingly, we offer these views on such leading practices in the hope of giving liquidity risk managers and architects additional insights and considerations that may be helpful in their continued efforts to build best-in-class liquidity risk management capabilities. Such considerations of these leading practices should be made within the context of an institution's

business model, size, scale, and complexity, as well as tailored appropriately to fit within the organization's structure, cultural and social norms, operating processes, and supporting infrastructure.

We have organized our views on leading practices along the following areas: (i) Governance and organization, (ii) measuring and managing liquidity risk, and (iii) optimizing business practices. Each of these areas is further discussed in greater detail in the individual chapters of this book. We conclude this chapter by summarizing additional considerations for institutions to ponder as they chart their paths forward and advance their capabilities in this critical risk management discipline.

GOVERNANCE AND ORGANIZATION

Liquidity Risk Management Oversight and Accountability

Strengthen Board Knowledge, Capabilities, and Reporting The events leading up to and stemming from the financial crisis highlighted the need for improved awareness and reporting of liquidity risk at the board of directors and executive management levels within financial institutions. Strong governance is critical in effectively managing all aspects of an enterprise, and liquidity risk management is no exception.

The board of directors of a financial services institution has the ultimate authority and responsibility for approving, overseeing, and monitoring its overall risk appetite and various individual components of its risk profile including liquidity risk. This overall risk appetite and profile, including the liquidity risk component, should be approved by the board to ensure alignment with the broader business strategy of the enterprise, and supported by relevant policies, procedures, roles, and responsibilities. As a practical matter, the board often delegates its authority for establishing liquidity risk appetite to company management in the form of committees, officers, and departments including the asset-liability committee (ALCO), enterprise risk management committee, corporate treasurer, and Chief Risk Officer (CRO).

Leading institutions are expanding board oversight of liquidity risk management to ensure the board has both a broad understanding of liquidity risk management concepts as well as sufficient knowledge of underlying technical details. Further, board reporting has improved to show greater depth and frequency of liquidity risk information and integration between business performance, financial, and other risk metrics to give boards greater clarity and integrated view into the changing business and risk profiles of their institutions.

Leverage the Three Lines of Defense to Align and Integrate Management of Liquidity Risk The three lines of defense depict the institution's internal risk management posture. Each line—the business, the independent risk management function, and the internal audit function—has specific responsibilities with respect to the end-to-end liquidity risk management process, from overall governance, strategic planning, risk appetite setting, risk identification, assessment, and management, through reporting, as well as internal controls.

In the context of liquidity risk management, corporate treasury, and/or ALCO typically serve as the first line and establish the firm's liquidity risk appetite with input and approval from the CRO and the independent risk oversight function. The CRO's independent risk oversight team provides the second-line defense, informing the setting of liquidity risk appetite and monitoring the institution's risk profile with a holistic view across different types of risk (e.g., credit, market, operational, liquidity) under changing market conditions. The third-line function, carried out by internal audit, is responsible for providing an independent, periodic assessment of the firm's internal control systems, including risk management, to the board.

While the corporate treasury function and ALCO bring both a business orientation and a risk management mind-set to their respective roles, it is important for an institution that follows an organization model comprising three lines of defense to empower its second-line risk managers to perform their own independent liquidity risk monitoring, review the assumptions and processes for decision making used by the first line, and challenge those views held by the first line that may prove vulnerable under evolving market conditions and thereby subject the firm to unintended risks. It is critical that institutions overcome legacy organizational silos to ensure that each line of defense effectively carries out its respective role with appropriate oversight and also achieves effective coordination and communication across the organization. A key ingredient to ensuring the effectiveness of second-line oversight is investing in the appropriate staff resources and training on new developments on supervisory guidance and industry practices to ensure continuous and well-informed effective challenge rather than periodic "check the box" reviews.

Overall Risk Culture

Lead and Inspire by having the Right Tone at the Top Effective risk management increasingly depends on the corporate culture to motivate, promote, and support prudent risk taking along with appropriate risk management policies and procedures. While risk policies and procedures might be in place, organizational leaders who do not lead by example jeopardize gaining the buy-in and confidence from their teams.

In setting and reinforcing the institution's risk culture, leaders must instill the risk management mind-set into employees. Leading institutions use rewards and consequences to demonstrate that risk management is everyone's responsibility. These firms maintain a rigorous recruiting process that embeds desired risk culture characteristics into hiring requirements and puts mechanisms in place to encourage escalation, rapid response, investigation, and attention by all employees. In instances where risk management raises concerns and objections to the actions or exposures taken by the business, executive management will need to review the relevant information and make decisions in accordance with the institution's risk strategy and appetite.

See the Independent Risk Function as a True Advisor and Partner to the Business Risks can be more effectively managed when they are controlled at the point of initiation—typically, by the business unit. Despite an increase in board-level support driven by a heightened regulatory environment, there remain additional opportunities for collaboration between the corporate risk and front office functions. Incentives, objectives, and level of influence are often mismatched, straining the corporate risk and front office relationship and making collaboration and actual risk management more challenging.

At leading institutions, there has been a fundamental shift in the firm's overall risk culture, with independent risk groups moving toward acting as risk advisors and business partners. Such institutions have strong risk cultures and improved collaboration in the organization by ensuring the risk management function has a seat and voice at the table. In this respect, institutions have implemented organizational and communication changes that support stronger partnership and collaboration between the independent risk function and business units by defining how risk groups are involved in key business decisions up front, and assigning key risk-related business decisions to those groups and individuals best equipped for execution.

MEASURING AND MANAGING LIQUIDITY RISK

Liquidity Stress Testing (LST)

Align Liquidity, Capital, Risk, Financial, and Performance Approaches and Methodologies Historically, the implementation of liquidity, capital, risk, and financial performance frameworks and tools have typically followed different time frames and paths, leading to variations and fragmentation in an institution's approaches, processes, and infrastructure/support systems.

Leading institutions are taking a more integrated approach to the management of liquidity risk by recognizing the complex interplay of liquidity

risk with market, credit, operational, and other risks. Operationally, firms are focused on addressing both business-driven and regulatory change imperatives by taking a more holistic approach to the design, development, and implementation of the overall risk management framework and its components. They actively seek to further align such risk management operating models, processes, and platforms over time to address the changing scope and scale of its business activities and leverage emerging technologies to meet evolving regulatory requirements. The results have helped improve business and financial performance management (e.g., risk-adjusted performance analysis, and product pricing), forecasting analytics (e.g., stress testing capabilities to evaluate joint potential capital and liquidity impact under severe adverse scenarios), data quality and reporting, and cost efficiencies stemming from increased system automation.

Apply Rigorous and Effective Challenge in Development of Models and Assumptions The importance of forecasting and risk models and associated model management practices has risen significantly over the past several years, particularly given their prominence in regulatory guidance pertaining to enhanced liquidity and capital stress testing requirements. In addition to the overall modeling framework and methodologies, there is significant emphasis on both the numeric values produced by models and the governance processes overseeing those values that are derived and/or determined by expert judgment.

In validating these model assumptions, leading institutions not only leverage existing model validation groups, but also follow a formalized governance structure in applying effective challenge to the models by involving senior stakeholders from senior management, business, finance, risk, and other support groups. Assumptions are scrutinized and challenged to evaluate their robustness. The focus on both the quantitative results and qualitative controls, including supporting documentation in the form of technical model descriptions, validation reports, and effective challenge session minutes, illustrates the high bar needed to effectively demonstrate sound risk modeling practices.

Design a Strong LST Framework, Starting with Key Elements, and Enhance Continuously The scope and complexity of significantly enhancing or building new LST frameworks and tools can be daunting, particularly given the heightened expectations of regulators and the many challenges that come with such an effort. Few institutions are immune to the various constraints of limited time frames, data quality challenges, scarcity of available resources, and cost containment pressures. Adding to those potential obstacles are the complexities associated with intertwining and

aligning different liquidity risk and capital-related methodologies for stress testing, business continuity planning, recovery and resolution planning, and overall enterprise risk management.

Leading institutions are developing a more strategic view of these enhancements and continuing to enhance their liquidity risk management capabilities, focusing on "core" or key enhancements needed to address immediate issues and/or pending regulatory mandates. They are implementing changes in a modular or phased manner that enables "quick wins" and allows them to maintain momentum by demonstrating success to internal and external stakeholders. Project plans include short-term goals and demonstrate long-term vision; planning horizons capture additional improvement opportunities with approved budgets for forecasted financial and staff resources needed to support the long-run efforts. Leaders in these institutions also take a more strategic and long-term view of liquidity risk management enhancement initiatives, seeing them as part of the institution's continuous improvement efforts rather than "one-off" regulatory compliance projects.

Intraday Liquidity—Risk Measurement, Management, and Monitoring Tools for Financial Institutions

Prioritize System Enhancements to Communicate Unanticipated Intraday Liquidity Events The batch processing approach used by many institutions captures the liquidity impact only from activities with more predictable cash flows, including loan events, investment banking activity, and securities that settle at known dates in the future. Other events, such as client cash and securities withdrawals, same-day settlement transactions, collateral calls, and clearinghouse payments, may result in unanticipated liquidity impacts that pose challenges for a batch process. To address these issues and improve the institutional awareness of the intraday liquidity position, firms are improving the flow of communication among the treasury, operations, and cash management functions. Before, these communications tended to be manual in nature, by email or phone, as the systems used by these groups traditionally did not communicate directly with each other during the business day to reflect client or firm activity that could unexpectedly impact liquidity.

By developing linkages between the daily monitoring systems used by treasury, operations, and cash management personnel to account for unexpected activities, leading institutions are now able to have these groups work more efficiently while reducing the potential for intraday liquidity surprises. Firms should continue prioritizing system enhancements for businesses that generate most of the unanticipated liquidity activity, such as prime brokerage, securities clearance, and trading (e.g., fixed-income,

exchange traded funds, and commodities). By focusing efforts on these businesses, an institution will capture much of its intraday liquidity pressure points rather than needing to undertake a very costly, extremely time-consuming, large-scale overhaul of its entire transaction processing and risk technology infrastructure.

Establish Linkages between Intraday Credit and Liquidity Monitoring In the years since the crisis, banks have enhanced their intraday credit risk monitoring to better understand risk concentrations across multiple asset classes, particularly with respect to trading counterparties. These efforts have resulted in the formation of specialized groups that monitor counterparty credit quality throughout the day and alert the businesses to declines in credit worthiness.

Cross-pollinating information between liquidity, operations, and cash management personnel with these credit risk–monitoring functions allows firms to better understand how credit problems can affect projected liquidity and expected cash flows. The credit risk team can alert liquidity managers of a decline in credit worthiness of a counterparty that is expected to settle transactions or make payments previously forecasted as part of the bank's liquidity pool, thereby allowing those managers to respond effectively by altering the liquidity composition and timing of payments of the bank to account for such potential losses. Credit considerations become particularly acute with respect to foreign currency exposure, as late or failed settlements from one counterparty may impact a firm's ability to obtain a currency that it must deliver to another counterparty.

Incorporate Intraday Exposure Analysis to Size the Working Capital Reserve A common approach to estimating working capital begins with projecting the daily liquidity sources and uses for business operations and then augmenting these projections with stress analysis of historical end-of-day exposures. The analysis includes stressing the liquidity reserve to account for potential disruptions in projected cash flows from events such as the failure of an agent bank or financial market utility, tightening of credit provided to the firm, or an increase in failed trades and delayed settlements.

While this approach highlights scenarios of potential liquidity disruptions during periods of market stress, it may not appropriately estimate the magnitude of these events. A firm's intraday liquidity needs could be significantly higher than its historical end-of-day exposure may indicate. Leading firms have now started to estimate their working capital needs using intraday exposures to account for these large spikes in business activity and the resulting liquidity needs throughout the business day that may not otherwise be reflected in end-of-day metrics.

The Convergence of Collateral and Liquidity

Invest in Collateral Management Infrastructure to Gain Cost and Operational Efficiencies and also to Extract Liquidity Risk Management Benefits The business case for upgrading collateral management capabilities is bolstered by placing liquidity risk management considerations squarely alongside the imperatives for improved credit risk management, processing efficiency, and cost savings. Collectively, such considerations are starting to drive implementation of unified target operating models, rationalized technology platforms, and greater automation within the world of collateral management.

While focusing on just the credit risk–mitigating aspects of collateral narrows the field of vision considerably, the broader reality is that heightened volatility in fast-moving capital markets activities can trigger unexpected collateral calls which, in turn, can increase an institution's exposure to firm-wide liquidity risk. In such instances, the ability to identify and mobilize eligible collateral effectively, to both meet margin calls and increase access to secured financing, can become the key to economic survival.

Integrate Collateral Management more Closely with Front Office and Treasury Functions Structural market reforms under the Dodd-Frank Act in the U.S. and the European Market Infrastructure Regulation are giving rise to greater pre- and post-trade transparency. At the same time, such reforms are also making market participation more expensive and operationally complex by requiring increasing quantities of high-quality collateral to be posted for both centrally-cleared and non-cleared swap portfolios. More stringent capital and liquidity regulations under Basel III require banks to hold greater quantities of the same high-grade collateral. The nexus of these different pressure points around collateral increases the business imperative to take a wide-angled lens view of how best to invest in cost-effective technology platforms and capabilities that can meet multiple business and regulatory requirements.

As exchange-traded execution platforms begin covering an ever-broadening swath of the derivatives marketplace, clearinghouse cross-product margining will continue to grow. There will be renewed focus on reaching beyond the cheapest to deliver in order to fully exploit the collateral eligibility of each available asset with greater differentiation. Achieving effective integration and management of both collateral and liquidity requires moving the collateral management function away from being purely a back office function focused on credit risk toward a domain requiring closer collaboration between front office and treasury functions to better facilitate sound trade placement decisions and leverage collateral to its fullest liquidity potential.

Optimizing Collateral Management Helps to Optimize Liquidity Risk Management Driven by the desire to source, fund, and allocate collateral efficiently, firms are focusing on achieving collateral optimization by putting in place cross-functional teams, rationalized operating models, common technology platforms, and proper collateral management processes. With optimization, leading market participants are starting to realize improved yield from each asset, minimize the cost of financing that asset, reduce capital charges associated with regulatory capital requirements, reduce liquidity risk, and eliminate over-collateralization. This represents the clear prize to be gained from combining capital and liquidity costs while simultaneously viewing collateral and liquidity as two sides of the same coin.

Early Warning Indicators

Select Internal Early Warning Indicators that Complement Market-Derived Measures Internally-focused early warning indicators (EWIs) provide a perspective on the liquidity profile and health of the institution. These measures are critical in understanding how the firm's liquidity position could be changing over time and what types of vulnerabilities may emerge as a result of business and strategic decisions.

Leading institutions supplement their use of external EWIs with a suite of internally focused indicators. These internal measures should capture trends in specific markets and businesses in which the firm participates as well as those that serve as funding sources. Internal EWIs should be selected in concert with external EWIs to identify emerging risks and evaluate if the nature of these risks is idiosyncratic, systemic, or some combination of the two. Many institutions select broad stock or bond market indices as indicators of overall economic health; however, leading firms will focus on indicators that are specific to their business and funding profile, such as loan portfolio performance, operational loss metrics, or industry-specific bond and swap spreads. Specific indicators may alert management to market trends and warrant further investigation.

Link the EWI Dashboard to a Strong Escalation Process Leading institutions select and calibrate EWIs and related thresholds to transmit meaningful signals to management about the need for corrective action in light of changes in the broader business environment or impending potential firm-specific distress. Once a EWI registers a change in status, a robust and well-established escalation process will help ensure that management (and potentially the board) reviews the trends to better understand the cause, identify the potential impacts of evolving business dynamics, and take appropriate actions. The firm's selection of EWIs and their calibration should be reviewed to

reflect any changes to business mix and activities and the changing nature of the macroeconomic and market environments.

EWIs should be forward-looking, selected so as to provide a mix of business-as-usual (BAU) and stressed environment information, and assessed against limits at predetermined intervals (e.g., daily, weekly, monthly). Continued deterioration in a single or combined set of EWIs should trigger the firm's emergency response tools, such as the contingency funding plan.

Contingency Funding Planning

Bring Contingency Planning to the Forefront and Align to Business and Risk Strategy Development The contingency funding planning (CFP) should serve as a critical component of the organization's liquidity risk management framework by ensuring that risk measurement and monitoring systems, such as liquidity stress testing, early warning indicators, limits, operating metrics, and regulatory ratios, are operationalized and drive timely management action in times of stress. The goal is accomplished most effectively by fully integrating the firm's risk identification and assessment, scenario development, stress testing, and limit structure into a robust CFP escalation process.

In designing and updating CFPs, institutions typically look to their existing business and risk profiles, risk monitoring capabilities, and external market conditions. While this helps establish a strong CFP at a particular point in time, the relevance and effectiveness of the CFP will likely change given the evolving nature of the institution and changing market conditions; therefore, ensuring the relevance and alignment of the CFP to the institution's business and risk profile and evolving external market conditions is key.

In addition to the periodic updates to the CFP, leading institutions are taking a more proactive stance on the development of the CFP by incorporating it as part of, or in parallel with, their strategic planning exercises, thereby positioning the CFP to be more forward-looking and flexible. As a result, the CFP's key features such as escalation triggers, EWIs, contingent actions, and strategies are more attuned to the institution's current activities as well as its projected areas of growth including new businesses, products, client segments, and geographies.

Further, the collaboration among relevant stakeholders from management, businesses, finance, risk, operations, and other supporting functions enables an improved forum for effective challenge discussions of key business forecasting assumptions and their associated impact on liquidity risk and operational strategies—particularly with respect to crisis response, alternative crisis funding arrangements, and relevant market dynamics—during potential periods of severe stress periods and market disruptions.

Align and Integrate CFP to Business and Risk Continuity Strategies While the CFP serves as a critical component of the liquidity risk management framework, it should be considered not as a stand-alone instrument but rather as a tool within the suite of capabilities and resources for managing the institution through a liquidity crisis.

For leading institutions, the alignment and integration of related capabilities, such as their business continuity planning (BCP) and recovery and resolution planning (RRP) strategies with the CFP, helps to standardize and streamline governance models, operating processes, and reporting tools and infrastructure, and further enhance management's decision-making capabilities, particularly during critical periods of severe market disruptions. This alignment requires common data taxonomies for defining/classifying the business and functional group segments and associated activities to ensure consistency across the enterprise. Additionally, institutions will need to define a comprehensive list of liquidity risk management applications and related systems, including front office activities, analytics, and reporting support, to ensure continuity of critical services under BAU and stressed operating environments.

Planning, Preparing, and Practicing for the Unexpected In a liquidity crisis, the importance and robustness of the CFP's design needs to be matched by the institution's ability to execute the playbook. Its people need to understand their roles and responsibilities under the streamlined command structure and its communication protocols so they can implement the steps needed to prepare for and manage the liquidity crisis.

The effectiveness in executing the CFP is further enhanced through periodic testing. While not all components/strategies of the CFP may be tested, leading institutions that perform frequent exercises which best simulate the potential liquidity crisis environment will improve the CFP's operational effectiveness and response times—aspects that are critical during a crisis. Further, the test simulations may also identify potential gaps and/or improvement opportunities that would otherwise be undetected if the CFP were left collecting dust on the bookshelf.

Liquidity Risk Management Information Systems

Enhance Ownership and Accountability of Liquidity Risk Data As regulatory reporting requirements have increased over the past several years, institutions have been challenged to keep pace with the ever-growing regulatory requirements for additional and more granular information. In stretching to meet pending regulatory deadlines while simultaneously juggling the needs to manage the ever-increasing portfolio of systems and applications, institutions have had little time to develop and implement a holistic approach to the

management of liquidity data. Consequently, this has resulted in data quality challenges, including incomplete or duplicated data, variations in reported results due to the use of multiple data sources, and increased manual and time-consuming efforts in reconciling and enriching information needed for reporting across the different parts of the enterprise.

Recognizing such challenges, leading institutions have often designated risk data "czars" to lead and coordinate data management practices across the enterprise, and spanning the risk data management lifecycle—including data capture, enrichment, quality maintenance, analytics, reporting, and archiving.

Manage Liquidity Data Comprehensively: From End-to-End and Top-to-Bottom Institutions leading the charge to improve their liquidity risk management capabilities have invested significantly in developing a comprehensive view of liquidity information, improved data quality, and "data lineage" as information is captured, enriched, analyzed, and reported.

Leading institutions have undertaken a spectrum of initiatives along the following focus areas:

i. Integration of risk, asset liability management, funds transfer pricing, transaction processing, and forecasting systems to enable more comprehensive data sets and shared common analytic engines/modules (e.g., trade capture systems, collateral management systems, G/L and financial systems)
ii. Standardization of liquidity data definitions and attributes through improved reference and position data collection (e.g., detailed features of product and asset class characteristics, contractual maturities of existing positions, overlay of behavioral assumptions), regulatory reporting classifications, and other segmentations (e.g., holding company, lines of business, legal entities/jurisdictions)
iii. Development of integrated analytics and reporting suites for multiple purposes (e.g., CFP dashboard metrics and thresholds, resolution planning, strategic planning and forecasting)

Develop a Vision and Continue to Build on a Scalable and Flexible Liquidity Risk Architecture As institutions continue to enhance their liquidity risk architecture and platform(s), they should remain mindful of the interconnections between liquidity risk systems and applications, ensuring that IT initiatives at the enterprise level and at other parts of the organization properly consider potential implications and considerations for liquidity risk as part of their planning and scoping exercises.

In this context, leading institutions demonstrate strong capabilities in several areas. First, they have a strong understanding of the information

technology, systems, and data "blueprint"—both the current and the future state design, along with detailed phased implementation and change management strategies and plans. Second, there is an executive owner, such as the chief information officer or a risk data czar, who provides oversight and drives coordination, ensuring a comprehensive view of liquidity risk data and how such information is used across the enterprise. Finally, there is a strong business case and well-defined requirements for IT investments, coupled with the support and buy-in from senior management.

Recovery and Resolution Planning

Embed Liquidity Needs for Resolution Planning into BAU Liquidity Reserves Resolution planning requires firms to identify and measure the liquidity necessary to resolve the firm in an orderly manner. Leading institutions use the liquidity estimates at the firm-wide and legal entity levels that are produced for resolution planning to assess the size of the liquidity reserves they will maintain to support liquidity risk strategies, both over the course of BAU activities as well as in recovery and resolution circumstances.

These firms model liquidity needs for their resolution strategies on a daily basis and adjust the size of their BAU liquidity base to ensure sufficient liquidity resources needed under recovery and/or resolution. They also set limits by using their resolution liquidity estimates and develop associated response actions, bringing them to the forefront of integrating resolution planning considerations into their liquidity risk management architecture.

Integrate LST and Contingency Funding Planning into the Resolution Plan In developing a resolution plan and addressing the resulting liquidity impact, institutions should make assumptions concerning sources and uses of funding, including deposit runoffs, drawdowns on outstanding lines of commitment, and additional collateral demands. As part of this exercise, many institutions leverage the assumptions in their liquidity stress testing and/or contingency funding plans to forecast the aggregate amount of net liquidity needed to support their resolution strategies. Leveraging existing liquidity risk management and forecasting tools in this manner is similar to the approach originally prescribed by the regulators of estimating required liquidity under the Liquidity Coverage Ratio (LCR).

Leading institutions are taking additional steps to further embed their own internal liquidity risk management tools into resolution planning by forecasting liquidity at set intervals (e.g., daily, weekly, monthly, and quarterly) throughout the resolution planning horizon. These projections better identify potential liquidity and funding mismatches that might not be readily apparent when strictly analyzing point-in-time, aggregate liquidity requirements.