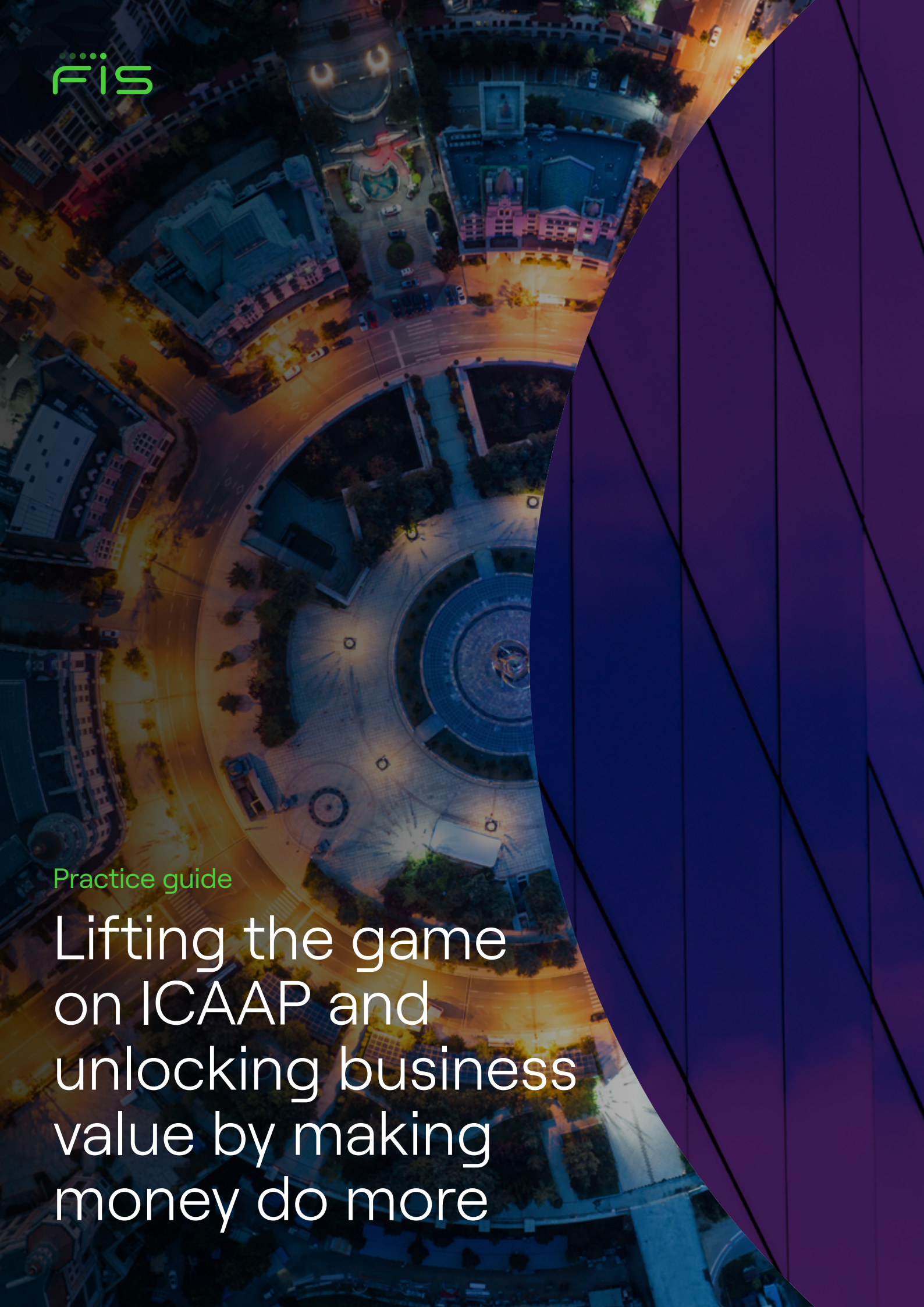


Practice guide

Lifting the game on ICAAP and unlocking business value by making money do more

Executive summary

Bank boards and shareholders seek to minimize capital buffers, the best way to do this is through better management of the ICAAP. Addressing these challenges requires investment in innovative technologies and proactive risk management to unlock business value and making those shareholder funds and investor money work harder.

The objective of the document (practice guide) is to illustrate how the logical building blocks of a bank's Internal Capital Adequacy Assessment Process (ICAAP) align with the functionality embedded within the FIS® Balance Sheet Manager solution.

The practice guide is divided into sections which align with the Pillars of ICAAP, namely:

- Business model and operating environment
- Material risk assessment
- Risk appetite statement (RAS)
- Capital planning and budgeting; and
- Enterprise-wide stress testing (EWST)

Within each section, the practice guide provides an overview of current market practices, accompanied by a statement of how to implement via the Balance Sheet Manager solution.

To provide the reader with sufficient context, the practice guide contains a preamble and an introductory section. The preamble section illustrates some salient historical challenges encountered in relation to the execution of an ICAAP. Whilst the Introduction section outlines some contemporary considerations facing the banking sector at the date of writing the document.

Finally, the practice guide concludes with a section outlining the linkages between the ICAAP and recovery and resolution planning (RRP) based on the concept of a stress continuum; whereby ICAAP is defined as the business as usual (BAU) region and RRP, incremental areas of management intervention.

Preamble: Challenges to implementing holistic balance sheet management

In a typical bank, the evaluation of multiple scenarios, the use of an iterative approach and ad hoc assessments may not be straightforward, partly because of unintended consequences of the Basel regulations:

- **Fragmentation:** Under the Basel regulations, banks must quantify their minimum capital requirements for credit risk, market risk and operational risk, and summarize these amounts. Within the supervisory review process under the Basel regulations, banks should quantify additional capital requirements for risks not captured, or not fully captured. In addition to their total capital requirements, banks must hold various capital buffers as prescribed in the regulations. Within the supervisory review process, banks should assess the capital buffer needed to ensure capital adequacy in a range of adverse scenarios. Under this fragmented approach, specialist teams may operate as silos, and may use different data sets, technologies and scenarios.
- **Volume and complexity:** To expand the regulations from credit risk to market risk and operational risk and to address shortcomings which became apparent in the banking crisis of 2008, the Basel regulations have grown from 30 pages in 1988, to well in excess of 1,500 pages. The volume and complexity of these regulations can have the unintended consequence of encouraging a focus on ensuring compliance rather than making judgements.
- **Capital buffers vs. capital requirements:** Despite the volume and complexity of the regulations for quantifying banks' minimum capital requirements, regulatory capital buffers are defined simply as percentages of banks' total risk-weighted assets. Stress-testing exercises may indicate the need for capital buffers higher than regulatory minimum levels. However, the time and effort spent on quantifying a bank's capital requirements can crowd out time and effort on evaluating stress scenarios and setting the bank's capital buffer.

Context and introduction

As at the date of writing the paper, globally, chief risk officers (CROs) are worried about increased volatility[1] in managing non-financial risks, including geopolitical risk (and geoeconomic relations between major economies), political polarization (misinformation/disinformation) and technology risks (cyber/criminal activity).

The mini banking crisis of 2023 reminded banking professionals of the dangers of ignoring[2] the traditional financial risks like credit risk in the technology sector, funding risk from rapid deposit withdrawals without insurance, and interest rate risk due to poor hedging strategies.

One noticeable difference, relative to prior market events, was the speed at which the 2023 banking crisis unfolded. This can be attributed in part to increased levels of consumption of social media (unstructured data) relating to the decision process of financial system participants.

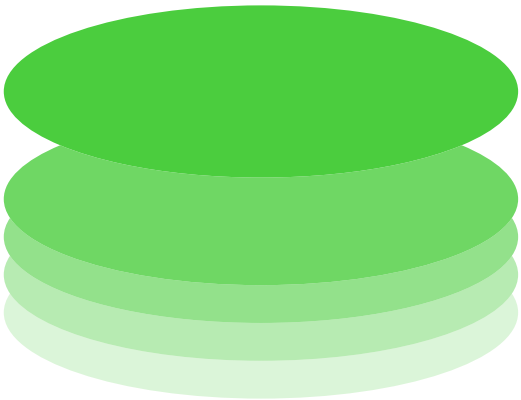
The objective of this guide is to illustrate how Balance Sheet Manager can drive operational efficiencies in relation to a bank's internal capital adequacy assessment process (ICAAP), thereby uplifting senior management and board level engagement.

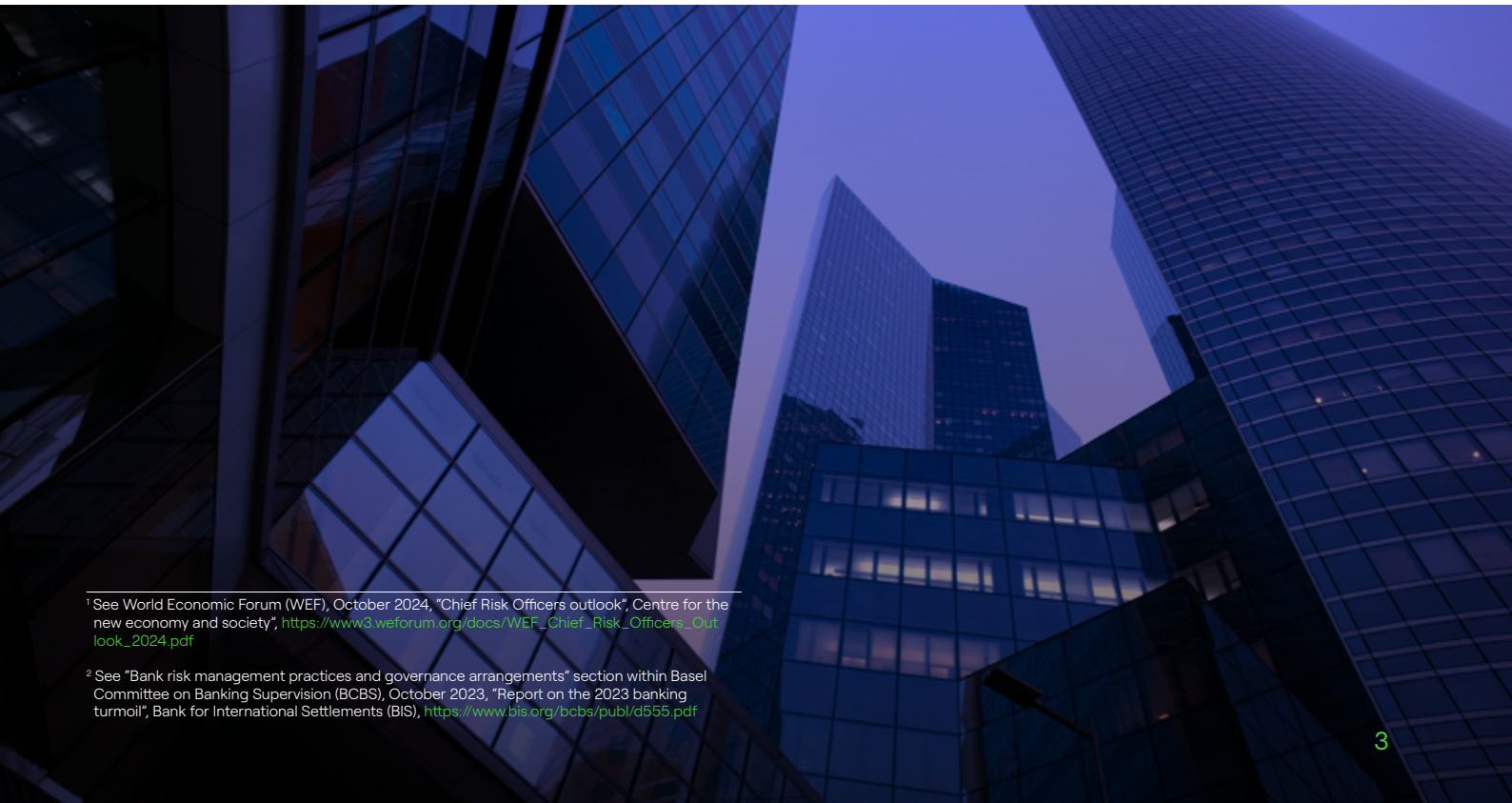
To help identify and mitigate potential problems, a bank's ICAAP must be forward-looking, focus on key risks and enable the board to make judgements rather than merely comply with banking regulations. Ideally, the ICAAP process should enable the board to make judgements about – and to set – the bank's business model, financial forecasts, risk appetite statement, possible management actions, capital requirements (for base case conditions) and capital buffer (for possible adverse stress scenarios).

The structure of this guide is aligned to building blocks of a bank's ICAAP:

- Business model and operating environment
- Material risk assessment
- Risk appetite statement
- Capital planning and budgeting
- Enterprise-wide stress testing (EWST)

The final section of this guide provides a preview of the next scheduled publication on the topic of recovery and resolution planning. Recovery and resolution planning are natural extensions of the ICAAP, given their connectivity to ICAAP on the stress continuum. The ICAAP can be considered the business as usual (BAU) planning process; recovery planning the internal corrective process; and resolution planning the external corrective process.





[1] See World Economic Forum (WEF), October 2024, "Chief Risk Officers outlook", Centre for the new economy and society", https://www3.weforum.org/docs/WEF_Chief_Risk_Officers_Outlook_2024.pdf

[2] See "Bank risk management practices and governance arrangements" section within Basel Committee on Banking Supervision (BCBS), October 2023, "Report on the 2023 banking turmoil", Bank for International Settlements (BIS), https://www.bis.org/bcbs/publ/d555.pdf

Business model and operating environment

The fundamental question that the ICAAP seeks to address is:

"Will the board be able to distribute its forecasted dividend payout to ordinary shareholders, whilst meeting its regulatory constraints (across capital, liquidity, funding and leverage), in light of its business model within the current operating environment?"

Here, we focus on the topic of how earnings and the ability to generate organic capital (via the retention of earnings), are likely to react based on the forecasted operating environment, over the capital planning horizon.[3] Earnings are driven by the range of services the bank provides and the operating environment. Modern bank services include:

- Accepting deposits, at-call and term, from counterparties with surplus funds and/or entities requiring transactional accounts
- Extending credit facilities to the sovereign, financial, corporate and retail sectors
- Providing payments, clearing and settlement services to financial market participants
- Raising and extending funds to the wholesale market (covering securities finance transactions (SFTs) and risk transferal products, such as swaps)
- Participating in capital markets and provision of investment services, ranging across primary (issuance, underwriting) and secondary (market making, proprietary trading) markets to advisory services

The relative order of these services' importance and their associated financial measures can then be used to categorize bank operations into one of the following business models:

- Universal bank: characterized by a relatively high net interest income as a percentage of the operating income; high loans and receivables relative to total assets; and a medium level of income from fees and commissions relative to operating income.
- Investment bank: characterized by a high ratio of trading income relative to operating income.
- Wealth management/private bank: characterized by a high ratio of fees and commissions relative to operating income, low lending to deposit ratio, and low lending to total assets ratio.

In the universal bank business model, the primary driver of an institution's organic capital generation comes via the profit and loss (P&L) item, net interest income (NII), which can be decomposed as the sum of the:

- Asset contribution: the spread earned on extending funds to the real economy and financial markets.
- Liability contribution: the spread earned on the banks investments and the rate paid its providers of funds.
- Treasury contribution: the spread earned by treasury managing the liquidity, funding and maturity mismatch.

Having identified our primary driver of earnings (organic capital supply), let's observe the causal factors (operating environment) that will influence NII. The operating environment is characterized by the:

- Macroeconomic outlook: considering inflation, real interest rates, exchange rates, equity market information (returns, correlations volatilities), credit spreads, commodity prices and alternative asset returns (infrastructure, hedge funds).
- Geopolitical situation: imposition of barriers to the movement of goods and services (e.g. tariffs and sanctions), restrictions on the flow of capital across borders (e.g. transfer and convertibility risk) and the outbreak of civil unrest and conflict (country risk).
- Reputation and regulatory environment: integration of environment sustainability and governance (ESG) considerations into the bank's business model and pre-empting regulatory revisions which may adversely impact (via imposition of floors/ceiling and/or standardization) on an institution's profitability.

In the case of the ICAAP, banks will generally select from two to five scenarios (operating environments) ranging from the base (corporate plan) to the extreme (reverse stress test/recovery planning) to assess the effectiveness of their business model.

[3] Across the Asia Pacific Region, one typically observes a forecast window of three (3) years; whilst in Europe, one typically observes forecasts out to five (5) years.

Returning to the case of the universal bank business model, in the case of the NII asset contribution, the first step in developing a coherent ICAAP is to project how the forecasted operating environment will impact sector and product earnings, for example:

- Sector: commercial real estate (CRE):
  - Continuation of the demographic trend to work from home, adversely impacting demand for office space and occupancy rates
  - Renormalisation of the interest rate environment which has adversely impacted the obligors debt service coverage ratio (DSCR) and loan-to-value (LTV) (via depression in property appraisal capitalization rates)
  - Opportunity to capitalize on the under supply of data centers to support the industrialization of artificial intelligence (AI) across the real economy [4]
- Product: trade finance:[5]
  - Sovereign nations are reassessing their trading counterparties based on economic and national security concerns (following on from conflicts in Europe and the Middle East)
  - De-dollarisation of trade flow and the rise of the BRICS+ trading block, move away from globalization (World Trade Organization (WTO)) to regionalization[6]
  - Impact of acute climatic events, such as hurricanes and typhoons, on shipping logistics which directly disrupt supply chains and cause delays

From a solution perspective, the asset liability management (ALM) module within Balance Sheet Manager allows the user to specify a coherent scenario via one (or a blend thereof) of three options:

- Historical-based: sampling from historical trajectories of macroeconomic/market factors; depending upon the sample window (scenario objective), scenarios can be benign, expansive or contractionary.
- Hypothetical-based: typically sourced from the bank's internal group economic team; alternatively, a blended scenario based on a central bank and/or multilateral development banks (MDBs) (such as the IMF, World Bank, ADB) forecast.
- Model-based: constructed via a series of stochastic differential equations or a multivariate time series model, such as a vector error correction model (VECM), calibrated on macroeconomic/market data sourced from third parties.

This naturally allows the user to investigate how changes in the:

- Pricing of lending facilities[7] (assets) and deposits (liability)
- Funding mix across deposits, secured borrowing, securitisation, covered bonds and equity
- Liquidity and funding portfolio holdings (mitigating the bank's asset/liability maturity mismatch)
- Asset run-off (back-book) and asset growth (front-book)

Directly impact the NII item, which in the case of the universal bank business model, is the primary driver of earnings, which is used to pay dividends to ordinary shareholders, subject to the restrictions imposed by the capital conversation buffer (CCB).[8]

The introduction of the CCB serves as a basis for pivoting into the next section of the guide, the material risk assessment. As the CCB effectively restricts the distribution of dividends (to ordinary shareholders) based on the ratio of common equity tier I (CET1) to total risk weighted assets (RWA). Where CET1 is primarily driven via the retention of earnings/organic capital and RWA risk profile and balance sheet growth.

[4] See CBRE 'Global Data Center Trends 2024' for supporting details, https://www.cbre.com/insights/reports/global-data-center-trends-2024

[5] Across the end-to-end value chain stretching across primary production, logistics (haulage, shipping, flight), storage / warehousing, and distribution

[6] See ING (2024) "De-dollarisation: more BRICS in the wall", https://think.ing.com/downloads/pdf/article/de-dollarisation-more-brics-in-the-wall

[7] Comprising of the Funds Transfer Price (FTP) rate, cost of credit (expected loss), cost of capital (unexpected loss), expense allocation and the profit margin

[8] "The capital conservation buffer was introduced to ensure that banks have an additional layer of usable capital that can be drawn down when losses are incurred." For additional details the reader is advised to consult BCBS (2019) "The capital buffers in Basel III - Executive Summary", The Bank for International Settlements (BIS), https://www.bis.org/fsi/fsisummaries/b3_capital.htm

Material risk assessment

In the previous section of the guide, we outlined the types of business models encountered in modern banking and how the operating environment, via structured scenario analysis, can impact earnings and ultimately organic capital generation.

This naturally leads to the topic of the identification and classification of material risks encountered by the financial institution in executing its corporate plan.

A logical identification process, in-line with the global prudential standards, sees risks being categorised into one of three groups:

- Pillar I risks based minimum capital requirements (MCR) covering[9]
  - Credit risk
  - Traded market risk[10]
  - Operational risk
- Adjustments to Pillar I risk capital measurement models
- Risks not included within the Pillar I MCR estimation framework (Pillar II risks)

One could, further categorise (inter-sect) these risks into:

- Financial risks: direct capital consequence of the issuance of financial instruments (e.g. loans, derivatives, deposits)
- Non-financial risks: indirect capital consequence relating to the supporting policies, processes and procedures

In the case of the universal bank business model, credit risk (inclusive of counterparty credit risk (CCR)) is generally the most material financial (Pillar I) risk, due to its direct exposure to:

- Loan receivables (on-balance sheet): via the extension of funded credit facilities to retail (mortgages, credit cards, personal loans) and non-retail (commercial real estate, shipping, manufacturing for example) counterparties/sectors
- Direct credit substitutes/performance guarantees (off-balance sheet): via the provision of standby letters of credit (SBLOC) to support cross-border trade flow
- Interbank/wholesale lending: via the placement of surplus funds with counterparties in the money markets
- Debt securities: via the holding of government and corporate debt issuances to cover liquidity and funding risks and profit from maturity mismatch
- Securitisation: via the extension of funding and liquidity facilities to self-securitisation vehicles
- Over-the-counter (OTC) derivatives: via the provision of risk mitigation products (such as interest/FX/commodity swaps) to its corporate clients to hedge their business model risks
- Securities financing transactions (SFTs): via secured lending, such as reverse REPOs, of financial securities to non-bank financial institution (NBFI) counterparties (for either trading or non-trading purposes)

[9] Regulatory prescribed 'material risks' as defined by the global Basel III (consolidated framework), April 2019, see: https://www.bis.org/bcbs/publ/d462.html

[10] The regulatory definition of 'Market Risk' extends to foreign exchange and commodity positions contained within the banks 'Banking Book' (or non-traded positions

Material risk assessment

Based on size, complexity, and inter-connectedness (within and across domestic and international financial markets), the bank has the option whether to measure regulatory capital on either a standardized[11] or internal rating (model) based (IRB) approach.[12]

There are several identified deficiencies associated with the IRB estimation framework, and as such an economic capital model (Pillar II adjustment) must account for:

- Concentration risk
  - Single name: the asymptotic single risk factor (ASRF) model, used as the basis for estimating the credit risk MCR, assumes that credit exposures are uniformly distributed across counterparties, and as a result, the default process is exchangeable. This is clearly a weak assumption in the presence of exposure to non-retail counterparties, where the exposure profile is typically skewed (non-uniform).
  - Group (economic[13] /legal): the ASFR model assumes default correlation is driven purely by dependence on a common factor (systemic risk); as a result, it omits idiosyncratic correlation which is driven by counterparties (legal entities) belonging to the same group.
  - Sectoral: the ASFR model assumes default correlation is perfectly and instantaneously driven by one (global) common factor; as a result, it omits diversification (or concentration) effects across a bank' exposure to global, regional, country, industry and size factors typically present in the Institution's credit portfolio.
- Adverse correlation: Probability of default (PD) and loss given default (LGD) joint dependency – pronounced in the case of transactional lending (to a special purpose vehicle (SPV)) where the cash flows, which are used to service the debt, are directly linked to the value of collateral (for example aircraft, commodity, land, property or ship) backing the credit facility.
- Target solvency level: the Pillar I MCR computation is explicitly linked to an insolvency rate of one in one-thousand-year event, ie a 99.9% confidence level.[14] However, the Institution's risk appetite, as measured via its external (long-term) credit rating, may differ from the BBB benchmark (based on the entities primary country risk rating and/or peer financial institutions external rating).
- Non-coherence[15] of value at risk (VaR) risk measure: in the presence of skewness (non-normality) VaR is non-additive and may result in a counter-intuitive result (e.g. super-additive of the loss functions). Hence, in the presence of skewness (driven by a non-granular/non-homogenous exposure profile) a bank should ideally adopt the use of an expected shortfall (ES) measure for capital measurement purposes. Subsequently, a coherent (full) allocation (ranging from a bottom-up facility allocation) can then be achieved via the application of a tail-contribution.[16]

[11] The risk weight is a static value based on the classification of the exposure; after which the risk weight is multiplied by the Exposure at Default (EAD) to compute the Risk Weighted Asset (RWA). Finally, the RWA is scaled to a 'Target Solvency' level

[12] The risk weight is a function of the Probability of Default (PD), Loss Given Default (LGD), Asset Correlation (ρ), and Maturity (M)

[13] An economic interdependence exists across two obligors if the financial soundness of a counterparty could materially affect the financial standing of another counterparty; examples: 50% or more of an entities annual gross receipts or gross expenditures is derived from transactions with the other counterparty, existence of cross-guarantee structures, counterparties rely on same sources for the majority of their funding

[14] "Equivalent to the upper end of BBB", Jackson et al. (2001) "Regulatory and economic solvency standards for internationally active banks", Bank of England

[15] The reader is advised to consult with Chapter 14, "Spectral Capital Allocation", Risk Books (2004) "Economic Capital: A Practitioner Guide" for a formal introduction to the concepts of coherence.

[16] Defined as the ratio of the "unit of measurement's" (facility for example) expected shortfall minus the expected loss, and the 'portfolio' aggregate expected shortfall mins the expected loss.

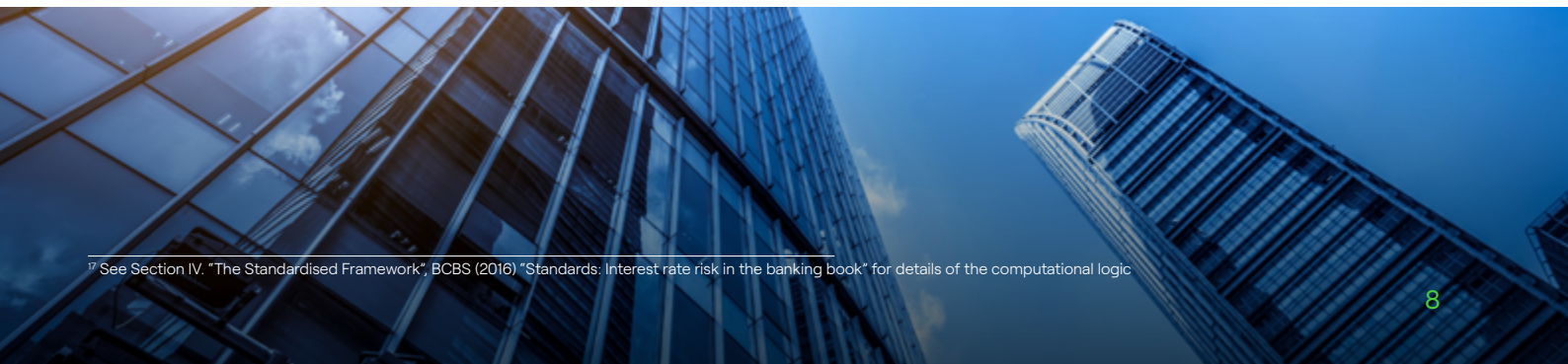
Having illustrated how one conceptually can adjust a material Pillar I (financial risk) MCR estimate, we now turn our attention to Pillar II financial risks. In the case of the universal bank business model, one typically observes non-traded market risk or interest rate risk in the banking book (IRRBB) is the most material financial risk; this risk can be further decomposed into:

- Repricing risk: loss of earnings or economic value (EV) due to unexpected changes in the overall level of interest rates arising from timing differences in the repricing dates of the Institution's assets and liabilities (inclusive of derivatives held in the banking book).
- Yield curve risk: loss of earnings or EV due to unexpected changes in the level, slope and shape of the yield curve (for all material currencies).
- Basis risk: loss of earnings or EV arising from differences between the observed and forecasted (corporate plan) interest margins on banking book items and represents the difference between the observed interest rates on instruments and the implied cost of funds for those instruments.
- Optionality risk: loss of earnings or EV due to cash flows varying from what the bank forecasted, caused either by counterparties exercising stand-alone or embedded options differently from how the institution had assumed they would, or by the operation of caps, floors and similar mechanisms that automatically adjust interest payments.

In line with the commentary embedded with BCBS (2019) "Overview of Pillar 2 supervisory review practices and approaches," Section 3.2 "Interest Rate Risk in the Banking Book," all supervisors expect banks, when quantifying the IRRBB capital charge to consider both earnings and economic value' based estimates. The table below provides a summary of the advantages/ disadvantages of the two approaches:

Table: IRRBB Measurement Basis

	Measurement Basis	
	Earnings Based	**Economic Value Based**
Advantage	• Based on a dynamic balance sheet (back-book (run-off) and front-book (new business)) • Linked to the corporate plan, naturally (via change in earnings) captures the risk of not achieving plan (due to interest rate risk) • Captures timing and quantum of financial instruments changes in response to all types of interest rate risks (repricing, yield curve, basis and optionality)	• Auditable: gap input, computation and output easily displayed on a single sheet • Reconcilable to accounting balance sheet aggregates • Easy to benchmark to BCBS standardized approach[17] for comparative purposes • Reasonable approximation for aggregate mismatch risk
Disadvantage	• Subject to significant model risk (via the number of assumptions to facilitate the model/subjective nature of the assumptions may lead to unachievable result) • Short-to-medium time forecast horizon (3-5 years, aligned with the ICAAP planning horizon) • Relatively (EV method) computationally intensive and challenging to implement	• Only truly effective if all financial instruments reprice on assumed reprice data and full amount (contingent upon selected scenario) • Based on a run-off balance sheet basis • Interval classification (time bandwidth) may provide a biased view of the fundamental balance sheet risk



[17] See Section IV. "The Standardised Framework", BCBS (2016) "Standards: Interest rate risk in the banking book" for details of the computational logic

Material risk assessment

Upon review of the stated advantages/disadvantages, one can understand why it's prudent to leverage both earnings and EV methods to quantify the IRRBB capital charge. The two approaches have significantly different time horizons (short vs. long), balance sheet basis (dynamic vs. run-off) and model risks (simplistic vs. complex).

Finally, in terms of the identification process, we now turn our attention to the topic of non-financial risks from a Pillar II perspective. Typically, the most material risk, non-financial Pillar II risk, relates to strategic risk. Given strategic risk isn't a regulatory prescribed requirement, it's prudent to start by first defining it:

> "Strategic risk is risk that results from incorrect assumptions about external and/or internal casual factors, misaligned (to operating environment) business plans, ineffective execution of business strategy, or failure to respond in a timely manner to exogenous risk factors (across regulation, macroeconomic/market trends, product obsolescence and/or technological developments."

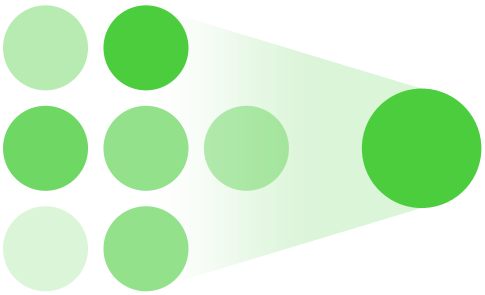
Issues like climate change (physical risk) and transition to net zero (transition risk), are two of the most significant drivers of a bank's strategic risk profile. Hence, a structured scenario analysis approach[18] (business planning) aimed at understanding micro/macroeconomic transmission channels[19] on the bank's earnings profile (NII, net trading income, fees and commission) is a natural process to mitigate the effects of climate risk (physical and transitional).

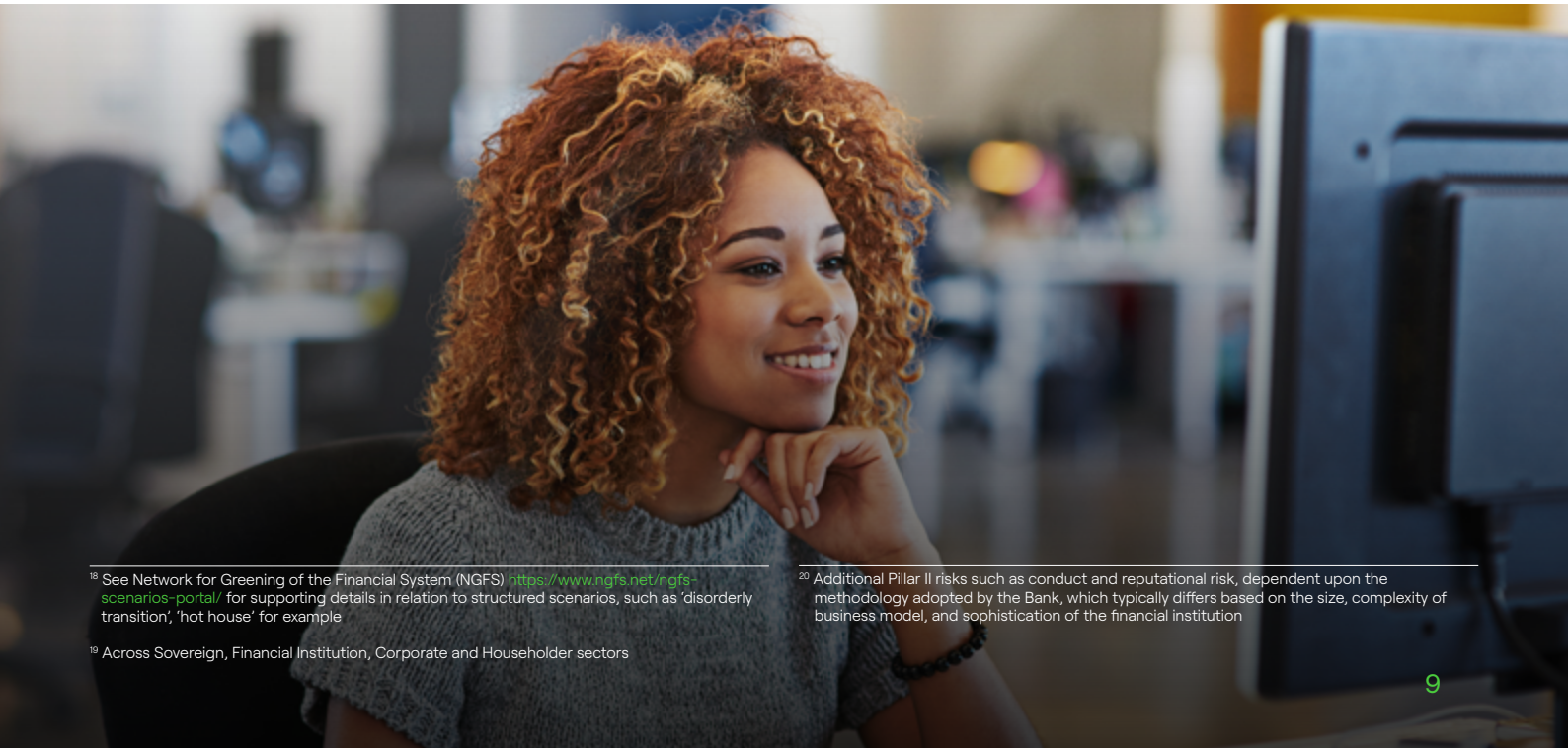
From a definition perspective, classification (material vs. non-material) is assessed via financial impact, considering (either/or) the quantum of the change in the risk profile with respect to capital ratios (i.e. common equity Tier I) and the financial statements

Now, turning our intention to how to implement (or measure) the risks as, discussed above:

- The Pillar I material risks, inclusive of Pillar II adjustments (economic capital) can be quantified via embedded logic statements and models within the capital management module
- Pillar II material
  - Financial risk, such as IRRBB, via earnings (such as NII) and economic value (such as economic value of equity) metrics, are measured via bespoke and standardised (regulatory prescribed) models within the ALM module; and
  - Non-financial[20] risk, such as strategic risk, measured via an earnings at risk (EaR) metric, can be quantified via the scenario generation capabilities embedded within the stochastic ALM module

Having outlined a structured identification and classification process based on the business model and operating environment, we now turn our attention to management. Management of the bank's risk management profile is achieved via the articulation of a risk appetite statement (RAS), which is the topic covered in the next section of this guide.





[18] See Network for Greening of the Financial System (NGFS) https://www.ngfs.net/ngfs-scenarios-portal/ for supporting details in relation to structured scenarios, such as 'disorderly transition', 'hot house' for example

[19] Across Sovereign, Financial Institution, Corporate and Householder sectors

[20] Additional Pillar II risks such as conduct and reputational risk, dependent upon the methodology adopted by the Bank, which typically differs based on the size, complexity of business model, and sophistication of the financial institution

Risk appetite statement (RAS)

A risk appetite statement (RAS) is the articulation of the aggregate level and types of risk that a bank is willing to accept or avoid to achieve its strategic objectives. It includes qualitative statements as well as quantitative measures expressed relative to earnings, capital, funding and liquidity. The RAS should also account for more difficult to quantify risks such as reputational risk.

When articulating a RAS, the bank should ensure a clear alignment between the strategic objectives (sub-bullet points below) and the institution's RAS (bullet points below), for example:

- Maintenance of adequate level and quality of capital to ensure solvency on a going concern basis.
  - Increase the bank's commercial real estate (CRE) industry (non-trading) limit to capitalize on the investment spend for data centers to support the industrialization of AI
  - Reduce the bank's country (non-trading) limits to BRICS+ aligned countries to constrain potential geopolitical risk (relating to sanctions and transfer and convertibility risk)
- Deliver stable earnings growth in-line with system.
  - Drive non-net interest income (NII) earnings, diversify income stream and reduce reliance on balance sheet and capital
- Access to efficient and stable funding.
  - Grow retail deposits continuously for funding stability and improve currency mix to ensure loan-to-deposit ratio of major currencies
- Maintenance of financial institutions reputation (as measured via a target external credit rating).
  - Balance business expansion and profitability with internal controls, prudent risk management and zero tolerance on non-compliance
  - Spearhead IT transformation for core systems and IT infrastructure to ensure sustainability and competitiveness

We choose to illustrate the RAS bullet item relating to funding and liquidity, having previously discussed capital and earnings metrics in earlier sections of the document.

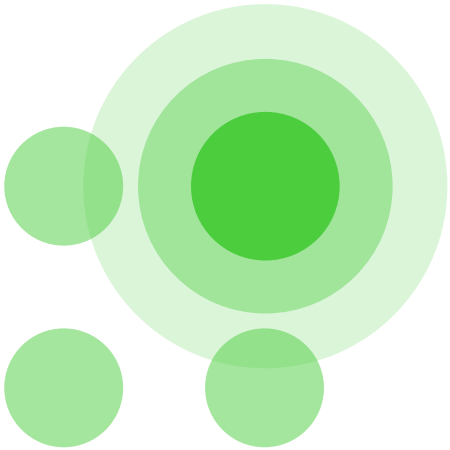
Annually, the Institution will document a three- or five-year (aligned to corporate plan/ICAAP horizon) funding strategy, with particular emphasis on funding strategies for the next financial year (i.e. forecast error proportionate to time).

The funding plan aims to confirm that obligor balance sheet projections (bottom-up forecast as provided by individual business units), in conjunction the institution's projected wholesale funding issuances, are manageable and aligned with the bank's RAS (relating to structural balance sheet settings).

The funding plan should include key strategies and initiatives the bank will execute over the funding horizon to address projected wholesale funding gaps and deliver a balance sheet consistent with its RAS, including:

- Wholesale funding capacity in chosen funding markets
- Liquidity coverage ratio (LCR[21]) and net stable funding ratio (NSFR[22]) targets, considering the outcomes of the liquidity and funding stress tests (across idiosyncratic, market wide and combined scenarios)
- Projected balance sheet volumes including for: obligor balance sheet, wholesale funding, liquid assets, capital; clearly denoting the institution's forecasted volume of long-dated (>1 year) term debt issuance, and projected change in short-term (<1 year) wholesale debt
- Target short-term and long-term wholesale debt issuance
- Forecast proportion of debt issuance by classification, i.e. senior unsecured debt, covered bonds, securitisation, Tier II capital (short-dated subordinated debt), and additional Tier I capital (perpetual/long-dated subordinated debt/quasi-equity)
- Funding matrix/diversification plan for debt issuance: market geography, currency, tenor
- Potential impacts of currency appreciation/depreciation on wholesale funding requirements
- Material risks to the funding plan: document alternative funding strategies in the event of adverse funding market conditions
- Sensitivity and scenario analysis to assess materiality of funding assumptions on the forecasted NSFR metric

An additional consideration, for international banking groups, is an assessment of country interchangeability, to assess whether there are restrictions in transferring surplus liquidity assets (i.e. above the risk appetite threshold) from one jurisdiction to another.



[21] a short-term measure, based on an extreme severity liquidity scenario (based on the 2007/08 Global Financial Crisis (GFC)). The LCR's objective is to ensure that sufficient liquidity exists to cover outflows over a 30-day extreme stress event comprising of both name specific and systemic (market-wide) factor

[22] a medium term (1 year) structural funding measure designed to ensure that longer term assets (where no liquid and secondary market / REPO exists) are funded within an appropriate proportion (based on the ability to sell / REPO the asset) of stable funding sources

From a quantitative (measurement) perspective the bank internally, as part of monitoring its funding and liquidity will identify certain key metrics across relevant categories, for example:

- External liquidity environment/market
  - The institution's 3-5 year single name credit default swap (CDS) spread
  - Functional reporting currency overnight (O/N) interbank borrowing rate
  - External credit rating
  - VIX (equity market volatility)
- Internal liquidity metrics
  - Stress test results (Survival horizon,[23] stress net liquidity position}
  - Cross border borrowing
  - Depositor concentration
  - Foreign exchange (FX) derivative positions
- Funding mix
  - Smallest surplus/largest gap (maturity > 12 (all material currencies))
- Regulatory metrics
  - NSFR
  - LCR

Marrying the concepts of the funding plan and key metrics, one then obtains (on an illustrative basis) the institution's funding and liquidity risk appetite settings:

Table: Management thresholds – funding and liquidity (RAS)

Metric	Description/basis for inclusion	Green	Amber	Red (Recovery Plan[24] Trigger)
LCR	Regulatory metric/ constraint: functional currency	> 125%	(125%,110%]	< 110%
Cumulative net cash outflow (NCO)	Set based on the liquidity shortfall the bank is willing to absorb, and liquidity supply the institution can source to address demand	Exceed NCO risk control limits for 1 week consecutively	Exceed NCO risk control limits for 2 weeks consecutively	Exceed NCO risk control limits for 3 weeks consecutively
Funding matrix surplus	Defined as the lowest surplus measured across the structural funding profile, partitioned into the discrete time bands	>$USD X	[$USD X, 0]	< $USD 0
Funding concentration	Defined as the ratio of the top 5 external (group entity counterparty) funding sources relative to the total sources of funds	< 15%	[15%, 20%]	> 20%

A logical question at this point would be, "How does one set these thresholds?" In short, thresholds are quantified (by each material risk category) via the application of a mild to severe stress test. Additional information can be found within the Enterprise-Wide Stress Testing section of the Practice Guide.

From a solution perspective, funding and liquidity requirements can be addressed via the Liquidity Risk module which provides out of the box LCR, NSFR and internal liquidity adequacy assessment process (ILAAP) functionality.

We now turn our attention to capital planning and budgeting, which serves as the primary input to the EWST, and provides the board with a view on the likelihood of success of their strategy over the planning window (subject to varying degrees of stress).

[23] The Net Cumulative Cash Flow (NCCF) quantifies the length of time ('Survival Horizon') before an Institution's cumulative net cash flow turns negative, once factoring in its stock of available liquid assets.

[24] The reader is advised to consult with 'Recovery and Resolution Planning' section of the Practice Guide for an explanation of the linkage between ICAAP and Recovery Planning, along with a high-level overview of the Recovery Planning requirements

Capital planning and budgeting

Capital planning aligns the bank's capital adequacy with the institution's risk appetite in both baseline and stressed conditions, leveraging strategic planning and stress testing to optimize the bank's capital structure.

The capital assessment takes into account the planned growth in on-balance sheet and off-balance sheet risk exposures.

The strategic and capital plan translates the bank's long-term strategy into measurable short-to-medium-term financial targets and enables intra-year performance management. The strategic and capital plan ensures alignment of earnings, balance sheet and capital targets including risk appetite with the strategy of the bank and provides the basis for ongoing performance management.

A bank manages capital base to main a strong position to ensure:

- The capital is sufficient to support current business activities and capitalize on both organic and inorganic (acquisition) growth opportunities
- Current and future regulatory capital requirements are satisfied
- The institution remains solvent (going-concern basis) and sound even under adverse scenarios
- Stakeholders, including shareholders, creditors, counterparties, rating agencies, regulators and employees, maintain confidence in the bank (maintain the financial institution's reputation and market standing)
- Continued access to financial markets and provision of critical functions (such as extension of credit facilities) to the real economy

Some historical weaknesses observed in practice (capital planning) relate to absence of sufficient granularity of projections, coherence of the forward-looking scenario and limited effective challenge from second and third lines of defense – which resulted in a biased (overly conservative or confident) forecast of the banks' capital needs, based on the board's strategy and risk appetite.

Limitations in information (velocity and comprehensiveness) provided to senior management has historically resulted in some banks distributing dividends to equity holders and engage in share buy-backs, when realistically, the earnings should have been retained to augment the institutions organic capital base.

BCBS (2014) "A Sound Capital Planning Process: Fundamental Elements" list four foundational pillars to any banks capital planning process:

- Internal control and governance
- Capital policy and risk capture
- Forward-looking view
- Management framework for preserving capital

The remainder of the current section of the document providers a view on key considerations when addressing the guiding principles outlined by the Basel committee. Aspects relating to items (c) and (d) (forward-looking view and management framework for preserving capital) are deferred to the next section

Capital planning and budgeting

Internal control and governance:

The board has the ultimate responsibility for the bank's capital management, with the following roles (sample basis):

- Set risk appetite and capital adequacy target fit for the bank's growth strategy and external environment; sign off on the ICAAP and ensure capital is sufficient to cover all material risks
- Monitor and sign off on the implementation of capital planning; ensure capital requirement is met on an ongoing basis and in emergencies
- Sign off on capital adequacy management plan; deliberate the capital adequacy management and ICAAP reports; and review the audit report on capital adequacy and ICAAP implementation at least annually

Capital policy and risk capture

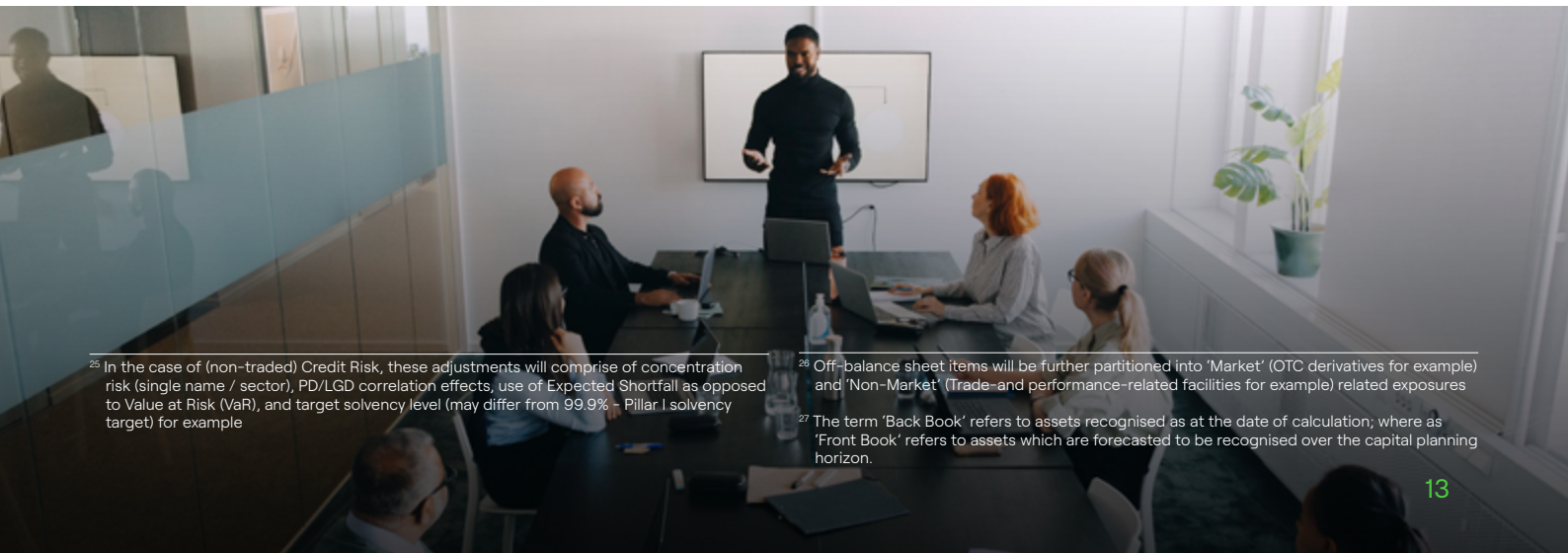
From a capital planning perspective, typically a financial institution will produce three (incrementally informative) capital projections:

- Baseline prudential capital requirements (PCR)
  - Conditioned on the baseline forward-looking stress test and accounting for only Pillar I risk (covering credit, market operational risks)
  - Regulatory capital buffers: capital conversation buffer (CCB), systemically important buffer (SIB), and countercyclical capital buffer (CyCCB)
- Baseline solvency position (pre-management actions)
  - Accounting for incremental Pillar I adjustments [25] (inclusive of regulatory capital buffers) and Pillar II materials risks conditional upon the varying degrees of stress tests
- Final solvency position (post-management actions)
  - Inclusive of risk mitigation strategies and capital injection plans

To deliver these outputs, the bank must produce a detailed financial plan includes balance sheet and income projections along with capital resources (capital supply) and capital requirements (capital demand) typically over a three-to-five-year planning period (depending on the operating region). The projections covering growth and revenue forecasts is a collaborative effort from the bank's business units and incorporates the business strategy to be implemented by the institution.

The structure and information (summarised basis) represents the core components of the bank's capital plan:

- Capital supply (common equity Tier I – organic supply) via income statements across:
  - Profit and loss (P&L)
    - Operating income: NII, net trading income (NTI), fees and income
    - Expenses: credit impairment charge, FTE/ administrative expense, additional Tier I and Tier II coupon values
    - Other financial items: FTE and administrative expense, depreciation, tax and dividends payable
  - Other comprehensive income (OCI)
    - Unrealised gains or losses relating to investment securities
    - Revaluation reserves (property holding, foreign currency translation)
- Capital demand via balance sheet: asset side (on/off-balance sheet [26]) partitioned in back and front books [27]
  - Growth and allocation across sub-portfolios (i.e. sovereigns, financial institutions, corporates and household)
  - Banking/trading book business model – risk-based capital requirements (RWAs Pillar I and II)
- Funding plan:
  - Required stable funding (RSF) – via balance sheet projection
  - Available stable funding (ASF) – via funding mix (liability and equity) projection



[25] In the case of (non-traded) Credit Risk, these adjustments will comprise of concentration risk (single name / sector), PD/LGD correlation effects, use of Expected Shortfall as opposed to Value at Risk (VaR), and target solvency level (may differ from 99.9% - Pillar I solvency target) for example

[26] Off-balance sheet items will be further partitioned into 'Market' (OTC derivatives for example) and 'Non-Market' (Trade-and performance-related facilities for example) related exposures

[27] The term 'Back Book' refers to assets recognised as at the date of calculation; where as 'Front Book' refers to assets which are forecasted to be recognised over the capital planning horizon.

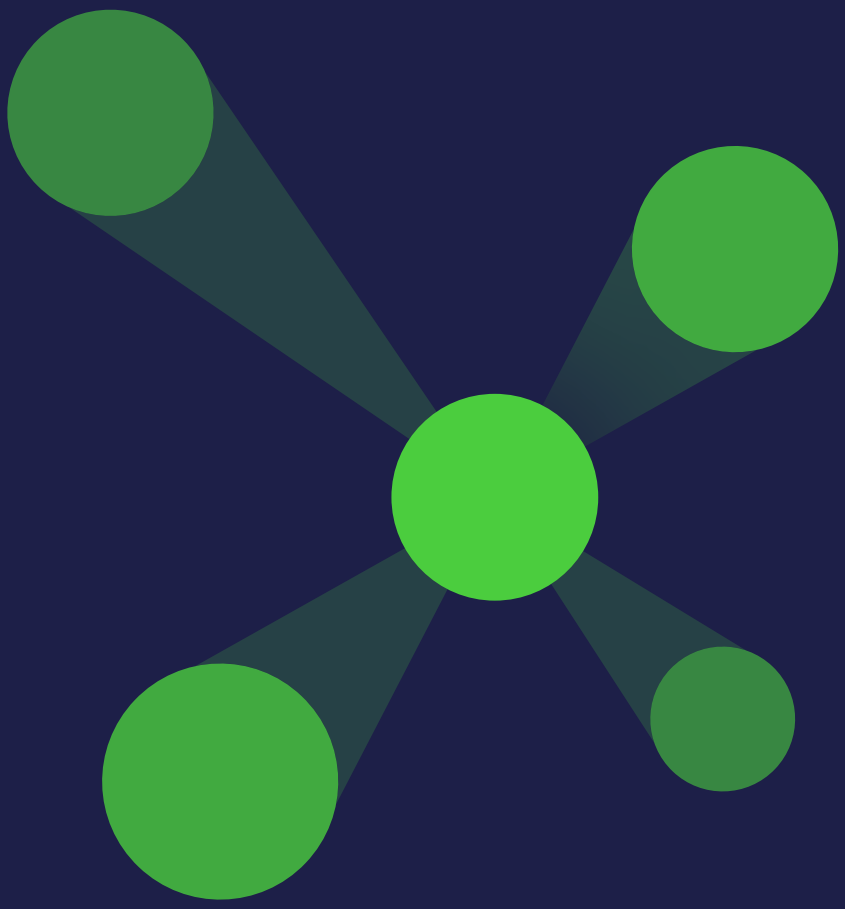
Capital planning and budgeting

An overview of the key aspects of a bank's funding plan was presented in the previous section (risk appetite statement (RAS)). As a result, we focus our attention on the projections/forecasts of capital supply (via retained earnings, organic capital) and capital demand (via balance sheet growth and risk profile (RWAs)).

As with any forecasting problem, the approach should leverage internal and external (market benchmarking) information and incorporate qualitative overlays (provided by the respective business unit). Just as important, the capital supply and demand forecasts should be monitored on a periodic basis and where significant deviations are observed, errors are explained/justified and forecasts updated.

For the readers benefit, we provide a high-level, qualitative example of some of the key considerations when generating the forecast of capital supply and capital demand (i.e. inputs to the baseline prudential capital requirements forecast)

- Capital supply:
  - Income statement: (in-line guidance provided in the business model and operating environment section)
    - The net income before tax projections over the forecast periods is driven by a combination of non-interest income growth from trading securities and OTC derivatives (i.e. cross-currency swaps, interest rate swaps, and FX forwards), fees and services incomes and NII from loan growth, holding domestic currency government securities and short-term placements in interbank and reverse repurchase agreements (repos), combined with policy rate assumptions. Non-interest expenses are mainly expense driven by the full-time equivalent (FTE) head count projection.
    - Key assumptions/forecasts:
      - Interest earned for domestic assets are priced relative to the central bank policy rates
      - Interest earned from holding domestic trading securities are forecasted to be x (spread) basis points (bps) over the policy rates throughout the planning period
      - Interest earned on local currency corporate loans are expected to be x (spread) bps over the policy rates throughout the forecast period
      - Fee income will be driven by investment banking, asset management, retail banking and trade finance related products
      - Earnings will also be dependent on shifts in the domestic currency and USD[28] yield curves, domestic appreciation/depreciation against the USD
      - Interest expenses for domestic liabilities – cost of funds (deposits) are based on central bank policy rate forecasts
      - Operating expenses are driven by inflationary expectations and long-run cost to income expectations



[28] Due to the banks' exposure to USD dominated trade finance exposures

Capital planning and budgeting

- Capital demand
  - Balance sheet (in line guidance provided in the business model and operating environment section):
    - The bank's balance sheet consists primarily of corporate loans, securities purchased under resale agreement (reverse REPO), holding of government securities (liquidity portfolio) and OTC derivatives. The sources of funding are mainly from savings and time deposits from corporate clients and supplemented with intra-group funds.
    - Key assumptions/forecasts
      - Corporate loans are projected to increase in-line Industry earnings
      - Trading securities are forecasted to remain constant throughout the planning period. The exposures are forecasted to approximately x% of the advised trading limits.
      - Other short-term placement with central bank and other domestic institutions are primarily for liquidity management purposes. Therefore, balances are expected to remain largely unchanged over the planning period.
  - Baseline PCR
    - In the capital demand forecasting process, each business unit defines its business strategy and performance figures over the planning horizon. Independent control functions within finance will provide effective challenge and oversight of the bottom-up forecasts. Individual business plans will be adjusted via a top-down forecast, to account for dependencies and inter-actions across the institution's business model.
    - Key assumptions/forecasts
      - Credit risk RWAs mainly stems from corporate loans and financial institution counterparty risks from OTC derivative trades.
        - On-balance sheet exposures follow the balance sheet growth that has been projected for the capital planning window
        - Risk weights are quantified via the projected distribution across the bank's default masterscale, tenor, collateralization and utilization of limits
        - Off-balance sheet commitments are assumed constant, given historical trends show that the institution's exposures have been immaterial
      - Market risk RWA mainly stems from OTC derivative contracts
        - OTC exposures and market risk RWAs are projected using a prior x-year average RWA
      - Operational risk RWA was relatively small as compared to credit and market risk RWA
        - Calculated using the gross income of prior x year-ends and applying a fixed capital charge
    - Regulatory capital buffers:
      - Set in-line with supervisory guidance and balance sheet growth projections

The above capital supply and demand projections can be translated into mathematical functions and implemented via the ALM and P&L planning modules embedded within Balance Sheet Manager.

Finally, once the pro-forma income statements, balance sheet and funding plans have been developed, the bank will then subject them to an enterprise-wide stress test (EWST). The objectives and approach to delivering an EWST are documented in the next section.

Enterprise-wide stress testing (EWST)

Within this final section of the ICAAP practice guide, we outline how a forward-looking EWST can be applied to the financial and capital plan, as outlined in the previous section, Capital planning and budgeting, to quantify the bank's projected stressed solvency buffer. This solvency buffer provides the board with a metric that quantifies the margin of conservatism (pre- and post-management actions) available to the Institution executing its current strategy over the planning horizon.

The foundational building blocks of any bank EWST include:

- Defining the objectives of the stress test
- Articulating the narrative surrounding the scenario[29] selected for the stress test
- Applying the chosen scenario to the measurement of financial and non-financial risks
- Document the management actions to mitigate the effects of the applied stress

The remainder of the section providers the reader with outline of how to address the EWST requirements.

Objectives of the stress test

Within the context of ICAAP, the following qualitative statements capture the core objectives of conducting the EWST, namely:

- Regulatory capital will remain above the PCR level given an extreme stress economic scenario (both on a stand-alone and banking group basis)
- Regulatory capital will remain in or above the top quartile of the capital conversation buffer (CCB) given a severe stress economic scenario – to prevent any regulatory intervention on the distribution of dividends to common equity holders – before/after the introduction of any associated management remediating actions
- The Basel Committee's leverage ratio (LR) remain above the home regulatory authorities minimums under both severe and extreme economic scenarios
- The bank preserves sustainable operating income aligned to the institution's capital targets (accounting for external regulatory requirements)
- For the purposes of quantify risk appetite tolerance thresholds for identified material risks

Once the objectives have been documented for conducting the stress test, attention must be turned to developing the

[29] For the purposes of ICAAP, a bank will typically select from two (2) to five (5) scenarios, where the scenarios will range from 'baseline' through to 'extreme' (inclusive, in more advanced countries to 'reverse stress test', aligned with the Institution's Recovery Plan)

Enterprise-wide stress testing (EWST)

narrative, or basis, for the projected stress scenarios. This topic is addressed in the next sub-section.

Developing the scenario (stress test) narrative

Consistent with BCBS (2018) "Stress Testing Principles," principle four (4) states:

"Stress testing frameworks should capture material and relevant risks and apply stresses that are sufficiently severe."

Stress test scenarios should be designed to capture material (as discussed in Section 2.0) and relevant risks specific to business model (as discussed in Section 1.0).

At a conceptual level, the bank runs two broad business models, which can be attributed to either the:

- **Trading book:** which covers the institution's trading positions, defined as assets and liabilities (inclusive of off-balance sheet items) and contingent/fixed contracts for future delivery or settlement, where the final value is a function of an observable market price or rate.
  - More specifically, trading positions, may extend to
    - Long or short positions
    - Profiting from short-term price movements or earning a longer-term margin or spread
    - Held as open positions or hedged
    - Illiquid or hedgeable and liquid instruments
    - Market-making activities or proprietary trading

of;

- **Banking book:** defined, trivially, as assets and liabilities (inclusive of off-balance sheet items) which are not held the in the trading book, for example:
  - Funded loans extended to the corporate and householder sectors
  - Credit-related contingent facilities covering guarantees, letters of credit and performance related contracts
  - Deposits: at-call or term
  - Derivatives held to hedge banking book positions
  - Strategic investments (or equities held in the banking book)

Naturally, arising from the definition outlined above, one concludes that the:

- Trading book business model is primarily driven by a fast-moving market[30]
- Banking business model is primarily driven by slow-moving factors, such as the global/regional/domestic macro-economic environment, geopolitical (geoeconomic) landscape and macro-prudential settings (covering prudential regulation, accounting standards, etc.)

In addition to external (or exogenous) factor considerations, the bank management must also account for internal (or endogenous) or idiosyncractic bank settings (covering financial and non-financial).

[30] Across Equity, Interest, Credit, Commodity and Foreign Exchange markets

Taking the cartesian product of the above scenario dimensions (i.e. velocity and nature), leads one to conclude a bank should consider six distinct scenarios, namely:

Table: EWST scenario narratives

		Nature of the stress scenario		
		Market-wide (a)	**Idiosyncratic (b)**	**Combined**
Velocity of the stress scenario	**Fast-moving (i)**	• Capital market collapse (global, regional, domestic) • Country risk (political disruption, civil unrest, terrorist event)	**Operational** • Acute physical risk (climate) • Fraud (internal / external) • Cyber-attack • Data breach **Non-operational** • Concentration risk (loss of significant source of funding - counterparty)	Combination of scenarios (a)(i) & (b)(i)
	Slow-moving (ii)	• Macro-economic downturn (global, regional, domestic) • Sovereign risk (default and currency event) • Regulatory revision	**Operational** • Mis-selling/litigation/ reputational • Management/strategy • Chronic climate change/ Transition risk **Non-operational** • Concentration risk (large wholesale counterparty default)	Combination of scenarios (a)(ii) & (b)(ii)

In practice, one observes there are three core methods by which a bank may parameterize and calibrate a set of stress factors aligned with the scenario narratives illustrated in the table above, namely:

- Historical event study (i.e. early '90s recession, 1998 Asian Crisis, 2000 tech bubble, 2008 Global Financial Crisis, COVID-19)
- Qualitative: designed and developed scenario internally via Group Economic; or
- Quantitative: a mathematical model, such as a vector error correction model (VECM), parameterized and optimized to a data set which captures the core macroeconomic / market dynamics (i.e. real interest, inflation, GDP, equity volatility, credit spreads etc.)

The key distinction between the three methods being, approach (1), by definition, is backward-looking in nature, whilst approaches (2) and (3) are forward-looking.

For the purposes of ICAAP and capital adequacy, the Institution must be mindful of the operating environment (across macro-economic and business cycles) it is forecasted to execute its strategic objectives. Hence, a forward-looking stress test is a critical step in validating the effectiveness of its strategy.

As a result, most banks in practice execute their EWST scenario generation via a combination of qualitative and quantitative techniques.

By way of benchmarking the projected EWST stress scenarios, it is commonly observed that banks will assess their forecast in line with scenarios or forecast supplied by:

- Regulatory authorities (such as the domestic prudential regulatory authority (top-down stress test) and the European Systemic Risk Board (ESRB [31]) for example)
- Multilateral development banks (MDBs), such as the IMF, World Bank, or Asian Development Bank (ADB), for example the IMF's (country specific) Financial Stability Assessment Process (FSAP)
- The World Economic Forum's (WEFs) Global Risk Report, updated annually

Having provided a clear basis for the projection of the stress scenarios, we now turn our attention to the application of the scenario via the impact on the financial statements of the bank over the capital planning horizon.

[31] See ESRB (2023) "Macro-financial scenario for the 2023 EU-wide banking sector stress test", European System of Financial Supervision, 23rd January 2023, https://www.esrb.europa.eu/mppa/stress/shared/pdf/esrb.stress_test230131~c4980ac646.en.pdf

Measurement of the scenario (stress test)

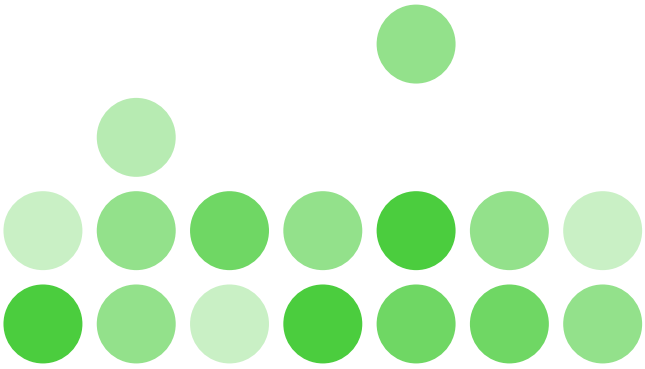
From a stress testing measurement perspective, the author has chosen to illustrate a fast-moving, market-related stress testing model within the context of counterparty credit risk (CCR).

The rationale behind the selection is two-fold: first, the loss distribution associated with CCR is skewed (due to the non-linearity of some of the underlying products) and highly procyclical and can result in significant losses; second, one can trace the root cause of Credit Suisse's demise back to the counterparty credit default of Archegos. This observed default was largely due to the fact the institution did not have effective risk strategies and risk management systems in place. The combination of market volatility and operational failure resulted in Credit Suisse issuing a USD S$2.7 billion margin call to Archegos, which ultimately resulted in their default and significantly reputational damage to Credit Suisse.

For context, counterparty credit risk (traded credit risk) measure is applicable for OTC derivative products, securities financing and REPO-related transactions. In the event of a counterparty default, under standard International Swaps and Derivatives Association (ISDA) terms and conditions, a derivative ceases to be a derivative and becomes a fixed amount that is payable to or receivable from that counterparty.

From a measurement perspective, a valuation adjustment is required for non-performance risk against the exposure to the counterparty for expected credit losses in the event of default to the extent that the valuation of their portfolio, adjusted for all other applicable reserves, does not account for counterparty credit exposure. For the remainder of this section, we will refer to this adjustment as a credit valuation adjustment (CVA).

Given (within the current section) we're simply illustrating general measurement principles, we'll ignore the bank's own credit adjustments for derivatives, debit valuation adjustment (DVA), to streamline the mathematical representation of the loss process.



Under the above definitions and constraints, one may define the theoretical CVA (loss function which drives capital demand within the setting of the stress test) relating to a specific counterparty netting set as:

$$\mathrm{CVA}_k = \mathrm{LGD} \times \sum_{j=1}^{T} D(t_j) \times q_k(t_{j-1}, t_j) \times \mathrm{EPE}_k(t_j)$$

where:

LGD Loss given default (LGD) [32] (relating to the defaulted derivative receivable)

$D(t_j)$ Risk-free discount factor for time grid point t_j

$q_k(t_{j-1}, t_j)$ Point-in-time (PiT) risk-neutral marginal probability of default[33] (PD) over the time-period $(t_j\text{-}1, t_j)$ associated with the k^{th} netting set

$\mathrm{EPE}_k(t_j)$ Expected positive exposure (EPE) at the time grid points $j \in \{1,..,T\}$ (where T represents the longest contractual tenor associated with the netting set)

$$= \left(\frac{1}{N_s}\right) \times \sum_{i}^{N_s} \max\left(\sum_{s \in k} \mathrm{MtM}^{s}_{(i)t_j}, 0\right)$$

where:

N_s Number of simulations

$\mathrm{MtM}^{s}_{(i)t_j}$ Mark-to-market (MtM) value for each traded position within the k^{th} netting set at time grid point t_j under the i^{th} simulated scenario

Hence, one can synthetically (via a Monte Carlo simulation) stress the market scenarios (i.e. volatilities, correlations, rates etc.) to numerically generate the potential CCR loss distribution to quantify the capital demand required as part of the ICAAP stress testing requirements.

As with any model used by a financial institution, the loss function (model) displayed above suffers from several limitations (model risk), namely:

- Absence of the offsetting effect of posted collateral
- Omission of specific wrong way risk (WWR) which captures the adverse (positive) correlation between the counterparties probability of default at the market values of the trades contained within the netting set
- Assumption of a constant loss given default, there are numerous empirical studies which point to the presence of an adverse correlation between the likelihood of default and the recovery

The reader is advised to consult with Section 5.0, Stress Testing and WWR, within European Central Bank's (ECB) 2023 "Sound practices in counterparty credit risk governance and management" document, for a more comprehensive treatment of the topic of CCR stress testing.

Taking a step back and returning to the broader topic of EWST, the following three tables provide the reader with a concise description of how the FIS Balance Sheet Manager solution modules can address all the components (such as CCR) of an EWST.

[32] In practice the LGD parameter is typically set at a value of 45% which is based on recovery rates (LGD = 1 – Recovery Rate) consistent with senior unsecured exposures.

[33] The reader is advised to consult with Section '3.3 Credit risk premia in the Merton framework' within Berg (2009) "From Actual to Risk-Neutral Default Probabilities: Merton and Beyond", Technische Universitat Munchen for a Mertonian approach to transforming real world PDs in to risk neutral PDs

Table: Measurement of the scenario (stress test)

Capital Stress Test	Description	Capital Demand (Impact of Risk Weighted Exposure)	Capital Supply (Impact P&L and OCI)	FIS Balance Sheet Manager – Module
Credit risk	Credit risk (banking book-loan loan equivalent (LLEQ)), securitization, counterparty credit risk (CCR)	Pillar II • CVaR incl. default, migration, concentration and settlement risk Pillar I: WIP • RWA (SA and IRB) • Securitisation • CCR (OTC / SFTs)	Provisions for impairment (ECL) incl. collateral allocation	Impairment Module, Credit Value at Risk Module, Capital Module
Operational risk (incl. conduct)	Impact of potential future losses arising from operational risk and conduct related events	Pillar II - LDA Pillar I: Standardised measurement approach (SMA), BI approach, and others	Operating expenses (provision)	Capital Module, P&L Module
Non-traded market risk - IRRBB	Stress testing must include: (a) consideration of a breakdown in the bank's key modelling assumptions, such as its repricing assumptions; and (b) scenarios based on sudden changes in the level of interest rates and changes in the slope and shape of the yield curve.	Pillar II • EVE • Earnings at Risk (EaR) – Value at Risk (interest rate) Pillar I: For Australian authorised deposit institutions (ADIs) (via Australian Prudential Standard (APS 117)	Credit spread risk (valuation impacts, OCI)	ALM (Static), Stochastic ALM
Traded market risk	Traded-market risk, credit valuation adjustment (CVA)	Pillar II: Value at Risk VaR (FX, interest, credit, commodity, equity, inflation products) Pillar I: FRTB (SA) and xVA as add-on components	Credit valuation adjustments (valuation impacts, OCI)	Market Risk Module, Adaptiv Add-On
Net interest income (NII)	All interest earning or interest paying positions across all accounting categories	Pillar II Earning at Risk (EaR) Δ NII	Full comprehensive income (valuation impacts - OCI)	ALM (Dynamic), Stochastic ALM, Hedge Accounting
Non-interest income, expense and capital	P&L and capital items not in scope of risk types or NII, for example: • FTE expense • Off-balance sheet/fee income • Dividend projection		Opex, Capex, fee income/expense, taxes, dividends, retained earnings	P&L Module

Liquidity stress test	Description	FIS Balance Sheet Manager – Module
Regulatory: liquidity coverage ratio (LCR)	LCR is a short-term, extreme severity liquidity stress scenario. The LCR's objective is to ensure that sufficient liquidity exists to cover outflows over a 30-day extreme stress event involving name specific/systemic factors	Liquidity Risk
Regulatory: net stable funding ratio (NSFR)	Medium term (1-year) structural funding measure designed to ensure that longer terms assets are funded with an appropriate proportion of stable funding sources	Liquidity Risk
Internal: wholesale funding capacity, funding planning	Internally developed metric designed to ensure that there are no undue maturity concentrations in the wholesale funding maturity profile.	Liquidity Risk
Internal: stressed net liquidity position (sNLP), survival horizon	Defined as: Liquidity Reserves – Outflows + Inflows (modelled over an x week horizon, under x liquidity scenarios, e.g. specific (downgrade), market-wide, combined	Liquidity Risk
Internal: liquidity pricing and funding costs	Pricing of required funding position	Funds Transfer Pricing (FTP)

Management actions: risk mitigation capital planning

In this section of the practice guide, we'll discuss potential management actions aimed at resolving the situation where the bank (in-line with the Baseline Solvency position approach, as outlined in the capital planning and budgeting section) projects a capital deficit and needs to implement a management plan to resolve the situation.

Potential avenues for management (risk mitigation) of projected capital deficits are:

- Raising additional external capital or capital from group sources
  - Raise Additional Tier I (AT1) , Tier II capital/conversion of AT1 instruments/ordinary share placement
- Balance sheet reductions/changes to business mix
  - Sell institutional loans/partial disposal of retail lending portfolios
- Expense reductions
  - Full-time-employee (FTE) reduction/deferral of projects
- Business (or lines of business) disposals
  - Sale and lease-back of significant property holdings/sell minority shareholdings
- Capital repatriation and/or
  - Via onshore subsidiaries/offshore subsidiaries and branches
- Optimize data capture and calculation models (i.e. remove margins of conservatism embedded within the ICAAP)
  - Remove management overlays embedded within the bank's IFRS 9 provisions for impairment

Execution of any management strategy at a minimum should (ideally) consider the:

- Financial impacts: addressing core financial measures such as capital (CET1, AT1, Tier II), total risk weighted assets, funding and liquidity, profitability and leverage
- Operational and strategic impacts: addressing considerations such as time to crystalising the benefit, management experience in executing the strategy/option (execution risk), approvals (internal/external), strategy dependencies (internal/external) and bank reputation

Understandably, the management strategy adopted by the institution will depend upon the nature of the project scenario, for example, in the case of a:

- Fast-moving (idiosyncratic) scenario: a cyberattack on the bank which results in both an operational and reputational loss,[34] spiraling, due to adverse social media coverage, into retail (deposit) run on the bank requiring the bank to execute a repo on high quality liquid assets with the Central Bank. Whilst capital will ultimately be used to absorb losses stemming from the cyberattack, in the immediate (short-term) future, the bank will need source liquidity to match the cashout flows.
- Slow-moving (systemic) scenario: a prolonged macroeconomic downturn (in a major export economy) due to the impairment of a significant trading partner, resulting in pronounced unemployment and foreclosures on residential mortgages requiring the bank to execute a sale and lease-back of significant property holdings on the bank's balance sheet to absorb the credit losses stemming from the defaulted loans.

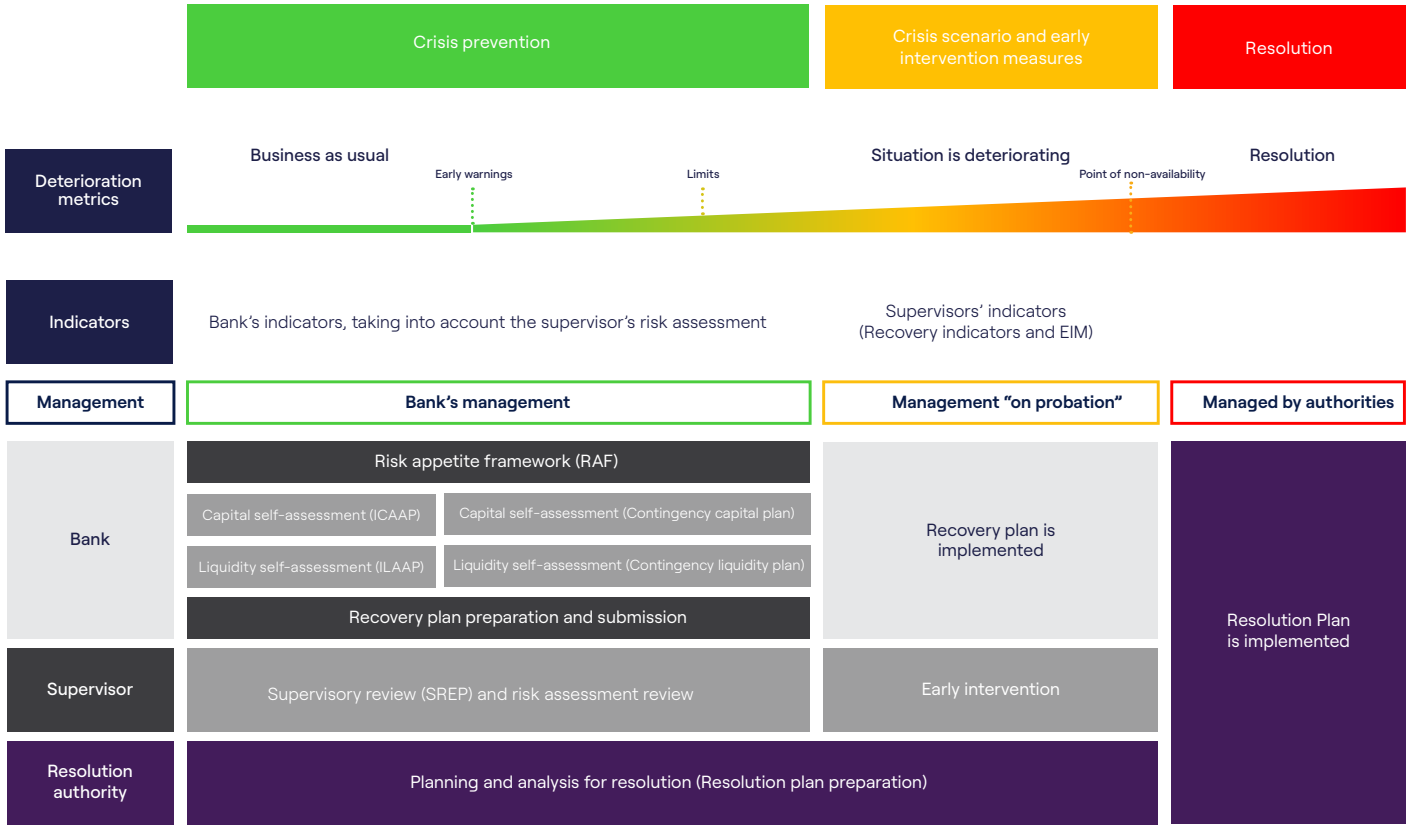
When documenting potential management strategies, one should be mindful to ensure consistency across strategies (or options) contained within the bank's ICAAP and recovery plan. We'll briefly discuss this interaction in the next section.

[34] Loss of future earnings and/or access to external sources of capital

Extending the Balance Sheet Manager use case: recovery and resolution planning

The figure below graphically illustrates the connection, via the stress continuum, between a bank's ICAAP (green region), recovery plan (amber region) and resolution plan (red region).

Figure: The bank's stress continuum[35]



[35] Figure sourced directly from World Bank (2017)"Early Intervention Measures and SREP in Light of Bank Resolution", Financial Sector Advisory Center (FinSAC) presentation

Upon inspection of the figure displayed on the previous page, a natural first question would be, how does one transition across the stress spectrum?

Assuming the bank is operating in a BAU environment (green region), the policy which governs a transition to the recovery state (amber region) is the bank's risk appetite framework (RAF), which was discussed in an earlier section of the document.

Embedded within the bank's RAF, there will be a set of documented risk-based limits (risk tolerance), across the defined set of material risks, following on from its business model assessment. The process used to quantify this risk tolerances is the EWST, via one of the elevated stress scenarios.

For example, the bank may transition from the BAU environment into the recovery state if the:

- Forecasted (stressed) liquidity coverage ratio (LCR) falls below 110% (for a period of five consecutive days for the bank's functional currency)
- Observed CET1 ratio drops below 9% (at the holding company level/point-of-entry from a resolution perspective); or
- Reported ratio of the IFRS 9 provision for impairment divided by loan and loan equivalent (gross carrying value) exceeds 5%

The bank will automatically trigger it's recovery plan and select the optimal set of recovery options to offset the financial impacts of the breach of its tolerance for risk, and where the recovery option should align with the ICAAP management strategy assuming a consistent scenario (i.e. fast (slow) moving', systemic/idiosyncratic/combined).

Given this consistency in the approach to risk management, and in light of the notion of the stress continuum, it makes sense to extend the use cases, applicable to Balance Sheet Manager, to the topics of recovery and resolution planning, specifically:

Recovery planning:

- Identification and assessment of critical functions (CFs) and core business lines (CBLs)
- Scenario analysis, recovery capacity, and recovery options

Resolution planning: aimed at supporting the financial resources barriers, namely:

- Funding in resolution (FiR): cash flow/funding projection of sustaining critical functions and core business lines over the resolution window (12–18 months post execution of the resolution strategy)
- **Valuation in resolution (ViR):**
  - Type 1: an accounting valuation (supporting failing or likely to fail asset)
  - Type 2: asset and liability valuation (supporting bail-in / wind down resolution strategy)
  - Type 3: equity valuation (supporting restructuring assessment); and
  - Type 4: no-credit worse-off (supporting rights of providers of finance)

The author will in due course publish a complementary practice guide on the topics of recovery and resolution planning.

Conclusion: next step

This guide has endeavored to impart an understanding and appreciation of the complexity associated with a bank's ICAAP across the supporting pillars:

- Business model and operating environment assessment
- Material risk assessment
- Risk appetite framework definition
- Capital planning and budgeting
- Enterprise-wide stress testing (EWST)

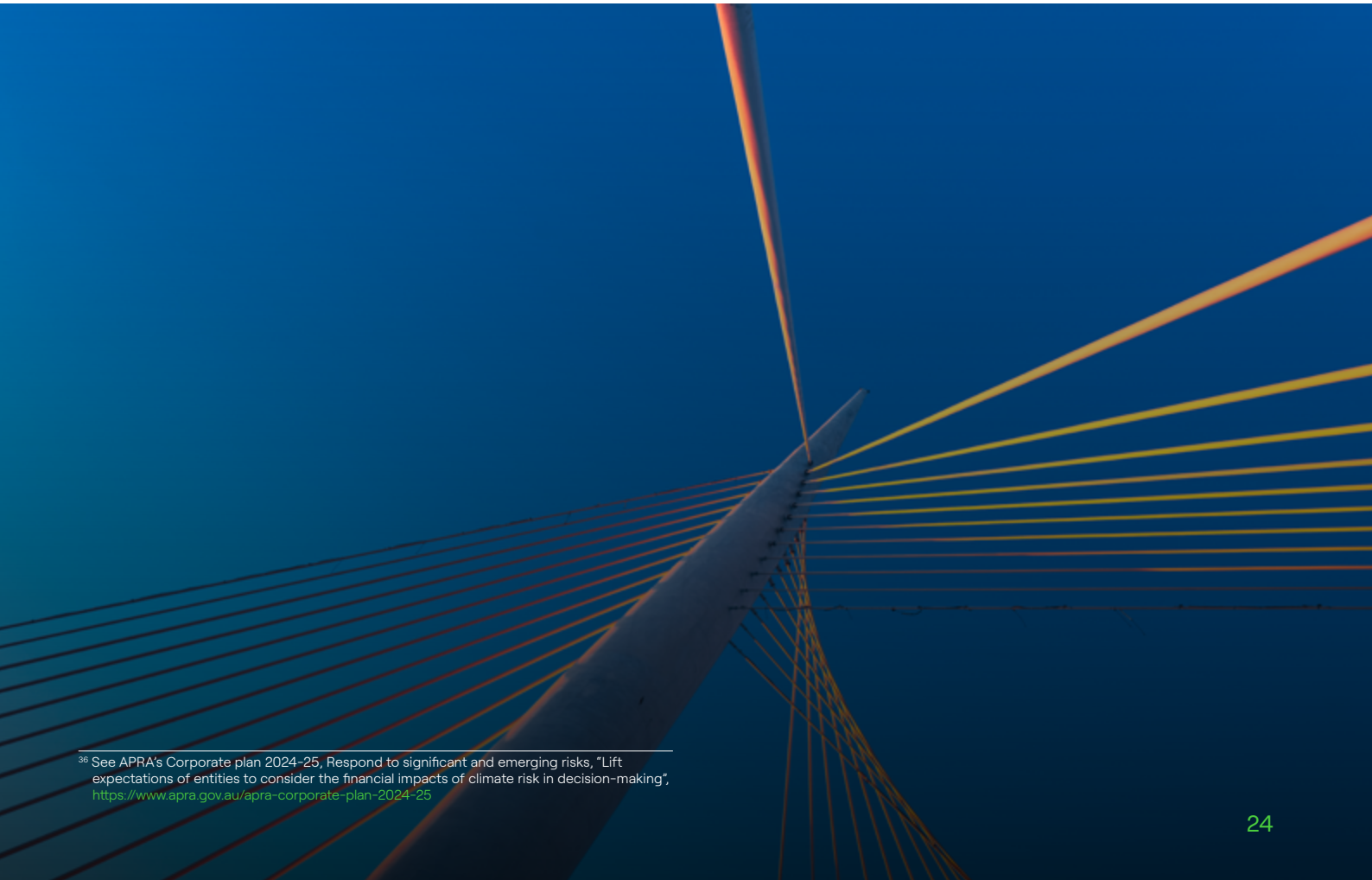
Additionally, this guide has been designed to explain how Balance Sheet Manager can assist in driving operational efficiencies in the execution of running an ICAAP and making money do more. The reader is advised to consult with ICAAP. Please see Appendix 1 for an illustration of an ICAAP template which can be generated via the solution.

Currently, there are several global prudential regulatory authorities looking for banks to uplift the degree to which the financial implications associated with climate risk, both physical and transitional, are incorporated into their planning and management activities (such as ICAAP).[36]

Due to the limited availability of comparable climate disclosure information across the economy (government, financial institution, corporate and householder sector), granular climate risk assessments are currently subject to significant model and parameter risk and as a result, not fully integrated into the ICAAP.

However, with the promulgation of initiatives such as the International Sustainability Standard Board's (ISSB's) S1 and S2 reporting standards, it is envisaged that the coverage and quality of climate data will improve in the coming years.

As a next step, we intend to update this guide to cover the specifics associated with climate risk and ICAAP.



[36] See APRA's Corporate plan 2024-25, Respond to significant and emerging risks, "Lift expectations of entities to consider the financial impacts of climate risk in decision-making", https://www.apra.gov.au/apra-corporate-plan-2024-25

Appendix 1: FIS ICAAP report template

See below for an overview of the FIS BSM out-of-the-box Internal Capital Adequacy Assessment Process (ICAAP) report template. The structure of the report is based on our experience working with globally and domestically systemically important banks (G/DSIBs) across the various geographies.

Due to the flexibility and breadth of the Balance Sheet Manager solution, we're able to modify and adapt the process supporting ICAAP and the resultant reporting structure (output) to capture the nuances associated with a bank's specific business model, should the need arise.

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