EXAMINATION

May 2020

Subject F206 – Banking
Specialist Applications

SOLUTIONS

QUESTION 1

You are employed as a senior risk specialist at a full-service bank that offers comprehensive financial services to both retail and corporate markets. One of your bank's clients, a large retailer, has just entered business rescue.

i. Outline with reasons, the commercial banking products that a retailer is likely to utilise [5]

The retailer may make use of some or all the following corporate banking products:

- Loans and other credit products:
  - This is typically the biggest area of business within corporate banking
  - The retailer is likely to make use of a loans and other credit products in order to finance large purchases, or expand its business
- Treasury and cash management services:
  - The retailer is likely to use this product in order to manage its working capital. This will be key to running its daily business
  - Excess funds will be deposited in order to earn interest and from which payments can also be made
  - In addition, it may use Treasury products in order to manage currency conversion requirements as it may be purchasing goods from several other companies, some of which may be foreign.
- Equipment lending:
  - Commercial banks usually structure customised loans and leases for a range of equipment used by companies in diverse sectors such as manufacturing, transportation, and information technology.
  - A retailer may use this product for IT infrastructure, or earlier on in in the production chain if the retailer produces some of its own items
- Commercial real estate:
  - Services offered by banks in this area include real asset analysis, portfolio evaluation, and debt and equity structuring.
  - The retailer may be investing in commercial real estate, for example where items are produced, or sold, or purely for investment purposes

- Trade finance: Involves letters of credit, bill collection, and factoring
  - These are typically used for import / export business, and so depending on the Retailers footprint in terms of sales (and importing of goods), it may or may not require these products

- Employer services:
  - Services such as payroll and group retirement plans are typically offered by specialised affiliates of a bank.

  - Its highly likely that the Retailer would need to use this product for payroll purposes.

- Capital market services to raise capital in the bond market given that the retailer is a large company

- Risk management services such as interest rate hedging of its own internal treasury function.

- Point of sale/ merchant services

ii. The Chief Risk Officer has asked you to evaluate the potential consequence (of this client's entering business rescue) to the bank and prepare a report. Discuss the points you will cover in the report.

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<u>Companies Act</u>

- A company going into business rescue indicates that it is in financial distress, but that there is an expectation that the business can be revived once the business rescue plan is in place.

- Section 6 of the Companies Act deal with this in particular

- As a creditor of the retailer, the bank would be considered an affected person for the purposes of the business rescue process.

<u>Process</u>

- The bank would be invited to meetings with the business rescue practitioner to present their interests for consideration in the preparation of the business rescue plan. The bank would need to appoint a representative to follow the business rescue proceedings and attend any relevant meetings in order to ensure its interests are appropriately accounted for in the business rescue plan.

- The report would need to indicate the appointed representative of the bank and the outcomes of any meetings to date that are material to the interests of the bank and may affect the risk of recovery.

- During business rescue proceedings, the bank, as a creditor, will be legally obliged to continue to provide services to the retailer in the same way they did prior to the commencement of the business rescue proceedings, unless the agreements between the parties regulated their relationship in the event of business rescue.

Contractual Terms

- The report would need to highlight any contract terms that would be relevant to the relationship under business rescue.

    - If there was no mention of business rescue in the contract terms, the report would need to highlight the obligations of the bank during the business rescue proceedings and the increased risk of loss as a result.

- If the contract did stipulate a change in relationship in event of business rescue, for example, changes in repayment terms or requirements in respect of attaching assets, it would be important to understand whether it is in the best interests of the bank to enforce the changes, if such an enforcement would further deteriorate the financial situation of the client and potentially force a liquidation (leading to long court proceedings, and a loss of future revenue which would have been earned should the business have recovered), or push the client to move to a competitor for its banking needs in the event that it recovers from financial distress.

- Typically, the business rescue proceedings should not exceed 3 months, however, there are instances where the period may be extended.

- The report would need to provide clarity on the bank’s ability to continue to service the client in the short to medium term, given its financial position and the resulting increased risk to the bank.

Likelihood of Success

- The report would need to give the CRO an understanding of the likelihood of success of the business rescue operation.

- This would be based on several factors, including industry analysis of similar businesses that have undergone the same proceedings, the bank's view of the company's financial position, management and governance structures and the credibility of the business rescue practitioner.

    - The bank's strategy will be largely determined by this expectation. If the client is expected to recover and the bank wishes to retain them, they would adopt a different response compared with the case where the expectation is less positive for the retailer.

    - The latter would call for a more aggressive recovery strategy (reducing the risk of losses for the bank) than the former (increasing the likelihood future revenues).

<u>Reasons for entering business rescue</u>

- Understanding why the retailer went into business rescue would also help in assessing the likely outcome of the proceedings. It may have been a voluntary decision of the board of directors of the retailer, or it may have been forced by another party such as a creditor or other affected person.

    - If the latter, then the success of the business rescue operations would be more doubtful since it would indicate a lack of confidence in the current management of the retailer.

    - If the former, it would be more likely that management is looking to save the business. The outlook for recovery would be more positive in this case.

<u>Economic Conditions</u>

- The potential success of the rescue would also need to be understood considering economic conditions.

    - If the economy is in a downturn, the chance of a positive outcome following the business rescue proceedings would be lower. The report would need to express the likely impact of economic conditions on the client and potentially on the portfolio, since there could be more companies seeking business rescue or facing liquidation when the economic outlook is poor.

    - Any effects on the bank's capital position going forward, should there be multiple clients going into rescue should be highlighted.

- Impact on suppliers of the client to who the bank is exposed to in terms of credit

- Measures that the bank could take considering a change in risk profile of the portfolio due to economic downturn can be discussed in the report.

- These should be in line with the bank's risk tolerances and planned responses to market stresses in the bank's risk appetite statement.

<u>Size of exposure and types of products</u>

- The report will need highlight the size of the client compared to the size of the bank's portfolio. If the client is large, then the consequences of them moving into business rescue will be more concerning from a capital and impairment perspective

- The main concern of the bank will be the credit exposure of the bank to the retailer. If there is a large amount of loans outstanding, a more detailed analysis of risk would be necessary.

- In this case the report would need to provide a breakdown of the banking products – specifically the credit products – held by the retailer and the corresponding changes in risk profile for each product given the financial circumstances of the client.

- Unsecured credit products such as overdrafts would see a significant increase in likelihood of losses, whereas secured products such as property finance would see a much smaller increase in likelihood of losses since secured creditors will rank higher than unsecured creditors both under the business rescue plan as well as under any potential liquidation proceedings that may happen in future.

<u>Letters of Credit and Guarantees</u>

- The bank would need to specifically consider any letters of credit that it may have offered in favour of the retailer, e.g. for the purchase of stock.

- During the business rescue proceedings, creditors may not be able to claim payment from the retailer but may be able to exercise the guarantee against the bank.

- If there are large values involved the bank may run the risk of significant claims in this respect.

- The report would need to provide details on the value of outstanding letters of credit. There may be an initial idea of whether these would pose a risk to the bank from the initial meetings held with affected persons.

- In this case the report should indicate the likelihood of claims arising from the letters of credit, and any claims the bank would then have against the retailer to recover these amounts.

<u>Past payment / loan performance history of the retailer</u>

- It would be important to understand the past relationship between the bank and the client and specifically the quality of the management team

- The report should indicate whether the retailer has had any missed payments on credit products in the past and any challenges the bank may have experienced in recovering monies owed.

- With this understanding the bank would be able to make better decisions regarding any adjustments to expectations of recovery.

QUESTION 2

Retail XYZ is a large retailer that operates only in South Africa. Their current business is to sell premium food and clothing to middle-and-upper income South Africans. Retail XYZ has always placed a significant emphasis on corporate social responsibility as well as innovation.

Retail XYZ is looking to set up a digital bank, Bank XYZ Digital, with the main aim of offering a full suite of personal banking products- Retail XYZ currently do not offer any financial products such as credit cards. Bank XYZ Digital is aiming to target two separate customer segments – namely its current customer base which are already banked with other banks and expanding beyond this segment to include previously unbanked customers. Initially Bank XYZ Digital will offer savings and personal loans products only.

You have been recruited by Retail XYZ to lead the banking licence application (a normal commercial banking license), as well as to set up the necessary infrastructure to run a digital bank.

i. In order to launch Bank XYZ Digital, Retail XYZ will need to apply for a banking licence. Discuss the key areas that you would be include in order to support the banking licence application and business case.

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Licence Application

- For Retail XYZ to apply for a banking licence, it will need to submit a detailed application to the SARB for approval.

- The licence application will be made in terms of the Banks Act 94 of 1990.

- A significant component of this application will be a detailed Business Case projection which will aim to illustrate that Bank XYZ Digital will be able to operate as a going concern from a financial point of view.

- This would need to be considered from the point of view of the SARB, but also from the point of view of Retail XYZ and Bank XYZ Digital’s shareholders.

- The Prudential Authority within the SARB would be mainly concerned with things like compliance with regulations and solvency.

- Under the twin peaks model, the FSCA would be interest in customer protection and treating customers fairly and market conduct.

- Whereas the shareholders perspective would mainly be around return on investment and profitability.

<u>Business Case Projection</u>

- The financial business case projection is likely to be for a period of 3 years and would likely include the projection of a detail Income Statement and Balance Sheet and its associated risks

- From a shareholders' perspective, a longer-term projection may be required in order to understand the return on investment.

- The business case from a shareholders' perspective would also need to consider the proposed funding model. For example, what will the sources of income be, and how these would be used to fund the business.

- The business case would also need to consider the capital structure, sources of funds for the capital structure, and revenues.

- Bank XYZ Digital will therefore need to map out the components of the IS and BS in order to then begin to estimate the individual line items.

- At a high level, the key components that will make up any Income Statement and Balance Sheet are sources of revenue (income) and expenses (outgo), and any regulatory capital requirements based on the evaluation of associated risks

- The first piece of information that will need to be included will be the types of products that Bank XYZ Digital will offer. It is stated that it intends to provide a deposit accounts and personal loans products.

Product Features

- These products would need to be designed to be competitive in the market in terms of features but would also need to be financially viable for Bank XYZ Digital in terms of pricing and expected volumes and credit experience.

- Sample product design specifications and templates are likely to be required. These would need to detail all the specific product features, terms and conditions, as well as sample loan repayment, fees, interest rates patterns.

Projection of Volumes

- Once the products have been determined, Bank XYZ Digital would need to include a projection of expected loan volumes by product and sub-segment for the required period.

- Personal Loans for example may be segmented into previously unbanked vs current customers of Retail XYZ, and as these are likely to experience different behaviour, they would need to be projected separately.

- The capital structure especially becomes important here if the loans business' funding needs exceed the liabilities generated from savings

- This experience is also likely to differ over time as Bank XYZ Digital becomes more well known in the market and as a result of marketing activities undertaken. This will need to be incorporated into the projections.

- The projection of customer volumes would need to include the number of new customers that Bank XYZ Digital expect to originate in each future period, including making allowance for turn-over (customers closing their accounts) and non-performing customers (bad debts).

- Bank XYZ Digital would need to develop detailed customer profiles for each segment in order to perform this projection.

Projection of Size

- In addition to projecting the number of customers expected, Bank XYZ Digital will also need to be able to project the expected size or loan / deposit per customer (ticket size).

- This is also likely to be different by product segment as well as over time.

- For example, Bank XYZ Digital may start off by granting only smaller personal loans (say less than R10,000) and then increasing the average loans size over time as experience develops.

- On savings accounts, interest rates offered will also need to be determined, and will likely differ by deposit size and term.

- Combining number of customers and average loan size, would give Bank XYZ Digital a good indication of the likely book size over time.

Projection of Credit Experience

- One of the most important inputs that will be required is expected credit quality. This will be required in order to estimate credit provisions on the loan book.

- It is likely that different products and different segments will have different credit experience. For example, for upper income customers known to Retail XYZ, better credit quality may be expected compared to previously unbanked customers.

- As Bank XYZ Digital are unlikely to have any existing scorecards and no existing customer base, they may also need to estimate credit experience by looking at annual financial statements or Pillar 3 disclosures of other companies.

- These are likely to be portfolio level loss ratios or NPL ratios. Bank XYZ Digital may need to decide on how to allocate these portfolio level estimates to its individual segments.

- Bank XYZ Digital will need this information in order to project is expected provisioning levels over the period, which is a key component of any balance sheet and income statement for a bank.

Loan Pricing

- Loan Pricing would be another key component of the business projection, as it affects both interest income, sales volume, and credit quality.

- Pricing for different product segments is likely to be different, with higher risk customers being charged more.

- Pricing will also need to consider competitive pressures and its unlikely that Bank XYZ Digital will be able to offer pricing terms significantly different from competitors.

- Pricing will also need to be in line with local regulations and legislation to do with interest rate caps for example.

Capital Requirements

- The SARB would also be interested the ability of Bank XYZ Digital to comply with the Capital requirements for South African banks. Hence these will also need to be projected over the 3-year period. A rudimentary ICAAAP may also be required.

- Specifically, the SARB would want to make sure that Bank XYZ Digital will be able to remain solvent and meet capital requirements under the current regime.

- It is likely that Bank XYZ Digital will be on the standardised approach for capital as it would not have the necessary data and experience to comply with more advanced capital approaches.

- It is also likely that Bank XYZ Digital's capital requirements would be in respect of credit, operational risk, and liquidity risk with limited exposure to market risk.

- Over time Bank XYZ Digital may move towards more advanced capital approaches, however this would take a 7 to 10-year time horizon.

- However, due to the onerous requirements of complying with advanced capital approaches, Bank XYZ Digital may choose to remain on the standardised approach in the long term.

<u>Expenses</u>

- Bank XYZ Digital would also need to think about projecting its expenses, which would include:

    - Staff costs – one of the largest costs for Bank XYZ Digital is likely to be staff costs as Retail XYZ is unlikely to have any existing staff that it would be able to use in new roles. It would need to recruit staff either permanently, or as consultants or contactors.

    - Rents and fixed assets – although a digital bank, there is likely to still be the need for some physical infrastructure such as an ATM network (possibly shared) and some physical buildings.

    - Advertising – As Bank XYZ Digital will be completely new, they will need to spend a significant amount on marketing of its products and services

    - IT infrastructure – Again, an entire payments platform, credit risk, customer information, reporting, and management information systems will need to be set up from scratch. Its unlikely much of this would be able to be leveraged from Retail XYZ.

- A significant amount of work would need to be performed in order to understand all the expected expenses for Bank XYZ Digital.

<u>Obtaining information for the projections</u>

- Given that Bank XYZ Digital will not have any existing customer base from which to set the assumptions for the purposes of the projections, it would need to be able to support its income statement and balance sheet projections using a combination of:

    - External consultant / external data. It may be possible to purchase analysis performed by external providers which indicate current market penetration, loan volumes, average ticket size, for similar companies or for the industry in general. A challenge with using external data is that it may not be representative of Bank XYZ Digital's actual customer experience.

  - Market analysis. Bank XYZ Digital may be able to perform an analysis of publicly available information using sources such as financial statements and other disclosures. As with using externally purchased data, this may not be comparable to actual experience. Additionally, publicly available data may not be at the necessary level of granularity that is required to perform these projections.

  - Analysis of existing customer base if Retail XYZ. It may be possible to form these projections based on information captured on Retail XYZ's existing customer base, particularly for the segments / products targeting their existing customers. It is common for retail customers to belong to some sort of loyalty scheme of the retailer and so they may be able to use this information in analysing customer spend and possibly infer income and other characteristics such as customer volumes.

  - Expert judgment. It is likely that Bank XYZ Digital will need to adjust any external data or market analysis to be more relevant to their expected experience and strategy. It may be that different scenarios are run and considered in forming their projections. It would however not be acceptable for the entire business case projection to be based on expert judgement as inputs without reference to available data sources.

<u>Operational Elements</u>

- The SARB would also be concerned about the ability of Bank XYZ Digital to be able to operate as a bank, and so would likely be interested in information with respect to how Bank XYZ Digital intends to comply with:

  - Banks Act – including the fit and proper assessment, risk management frameworks and policies

  - Companies Act

  - Local and international regulations and legislations such as IFRS 9 and Basel over time. Given challenges in data and limited internal capability, compliance with the standards may be a challenge, and Bank XYZ Digital would need to document a roadmap towards full compliance.

Company Structure

- The licence application will also need to include information on the proposed company structure, shareholders, governance structure (including key committees and members meeting fit and proper requirements)), key roles and responsibilities,

- The FSCA would be concerned with how the business plan meets the requirements of good market conduct, ensuring that the business is sustainable for the financial services ecosystems, and meets customers' needs.

ii. Discuss the key areas of infrastructure (physical, people, process, etc) that Bank XYZ Digital will need in order to operate as a Digital Bank.

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Introduction

- Even though Bank XYZ Digital intends to operate as a digital bank, implying less infrastructure than a traditional bank, it would still require a significant investment in this area.

- This is especially true as Retail XYZ is currently not offering any financial products, and hence there will be limited ability to leverage existing infrastructure and processes.

- Some of the key areas of infrastructure and process that would be required include:

Product Design

- Product design team. Given that Bank XYZ Digital would not currently have any products, and Retail XYZ would not have experience in banking product design, they will need to recruit experienced staff to assist in this component.

- They may also choose to look at what competitors are offering and decide to copy these products initially.

- Although this may be challenging as the required level of detail is unlikely to be publicly available.

- Furthermore, in designing a product, Bank XYZ Digital would likely want to be innovative and differentiate themselves from their competition and incumbent players. As a result, they would most likely invest in a product design team to help ensure that they can meet these objectives.

Loan Origination

- Once the products have been designed, Bank XYZ Digital would need to invest in infrastructure that would allow them to originate loans.

- This would include
  - Customer Scoring
    - models would need to be developed in order to assess applications. It may need to be a vendor model or expert judgement model due to limited internal data, with a gradual transition into a more internally developed and calibrated model

    - approval cut offs would need to be determined, below which customers would be rejected, and above which customers would be accepted

  - Deposits and Disbursement
    - infrastructure would be needed for loans to be issued to customers and for customers to be able to deposit funds into savings accounts.

    - This could be in the form of alliances with existing ATM infrastructure, setting up its own infrastructure, or withdrawals at existing Retail XYZ branches.

  - Data capture
    - systems would need to capture all the right information at a customer level at the point of application (amount disbursed, credit score, payment terms, etc)

Customer and Portfolio Monitoring

- Once loans have been originated, Bank XYZ Digital would need to be able to track these loans and balances over time, and hence would need a loan system / platform that allows it to do this.

- This would also be a key input into monitoring of credit quality of the loan portfolio and ensuring that the business is running as intended.

- Where customers fail to make payments, these would also need to be identified and tracked.

- For these customers, their outstanding balances and interest will need to be recalculated, and the amounts aged in the system.

Provisioning

- Provisioning amounts will also be dependent on this information as customers that are delinquent will typically carry higher provisions.

- Provision calculation and reporting would also require a system. It’s likely that this will need to link to the customer and payments systems.

- The provisioning system will also need to incorporate outputs from provisioning models and will need to be set up to produce monthly, quarterly and annual reporting information by applying these parameters to customer level information.

- This information will be needed for management reports, as well as financial statements.

Capital

- Like the above, systems and software will be required to produce the necessary capital information for reporting purposes.

- The capital calculation and reporting system may be separate from the provisioning system or could be a submodule within the provisioning system.

- Capital reporting should however be relatively simpler due to the high likelihood of Bank XYZ Digital being on the standardised approach.

Corporate Governance

- Bank XYZ Digital would also need to set up the processes and infrastructure to support its own corporate governance.

- This would involve establishing several committees, such as the credit risk committee, model approval committees, audit committees, management committees etc.

- These would likely need to be separately established as Retail XYZ's existing committees would not be set up and able to deal with the requirements of running a digital bank.

- Depending on the corporate structure between Retail XYZ and Bank XYZ Digital, some of these committees will report into Retail XYZ.

People and Skills

- One of the main areas of investment will be in the recruitment of staff and necessary skills required to operate a digital bank.

- This would include staff positions such as CRO, CFO, CEO, the Credit Risk Team, IT Teams, Collections teams etc. These would be essential in running a bank.

Collections

- Setting up a collections team and process will be required.

- Initially defaults are likely to be low as it will be an entirely new loan book.

- However, as experience progresses over time, customers will start to miss some payments, and Bank XYZ Digital will need a team to collect against these bad debts.

- Another option would be to outsource this function, which would probably be a better decision from a cost and infrastructure point of view, especially given the potentially small loan book and bad debts volumes in the earlier years of operations.

Customer Support

- A key area of infrastructure that would be required would be to establish a customer support function.

- This would require website design, phone lines, a mobile application function, and staff to deal with complaints and customer issues.

- This function would be incredibly important for a new bank trying to break into the market and increase its loans volumes.

- Having a dedicated customer support team with experience in the products and customer queries would be key to retaining customers and avoiding bad publicity.

- Ensuring customers are treated fairly and that customer information and privacy standards are adhered is a key consideration

Management and Regulatory Reporting

- Bank XYZ Digital would need to be able to establish the capability to produce internal management reports, as well as financial and regulatory reports.

- The reports would also need to be designed and be in line with the requirements of the auditors and regulators.

- Bank XYZ Digital would also need skilled staff to be able to interpret the reports and take decisions based on these.

- For example, if the reports indicate that loan volumes in certain segments are growing too fast, the approval process may need to be adjusted.

- Similarly, if credit quality is deteriorating, approval metrics may need to be adjusted to originate better quality risks.

Marketing

- A significant investment is likely to be required into a marketing team. For Bank XYZ Digital to meet its sales targets, significant efforts will be required to advertise the new bank and its offerings, especially as it’s a very competitive market.

- The marketing team would need to design campaigns as well as integrate into websites and mobile applications.

- A mobile application would be required. These are usually associated with “digital” providers and so for Bank XYZ Digital to be credible, and to grow its loan portfolio, they will need to invest in developing a mobile app.

- It would be expected that the brand around Bank XYZ Digital is modern and in line with being a digital bank.

Systems

- A significant investment in systems will be required to produce all the above and maintain data and reporting.

- It’s highly unlikely that existing Retail XYZ systems will be adequate for Bank XYZ Digital’s needs.

- It’s likely that multiple different systems would be required, and these would need to be integrated for Bank XYZ Digital to be able to operate as a bank.

- Bank XYZ Digital would need to invest in general IT infrastructure, including servers, internet, hardware and software.

- IT infrastructure is likely to be a very significant cost for Bank XYZ Digital.

Cybersecurity, Fraud, AML, KYC

- Bank XYZ Digital would also need to invest in systems and capabilities that help detect and protect against fraud.

- This would also include AML and KYC requirements, and ensuring that the Bank XYZ Digital is able to track customers and verify the source of funds and ensure that these are legitimate.

- As a digital bank, physical verification of ID and documents is likely to be limited. And hence software that can perform OCR and linking to national databases may be needed.

- Cybersecurity will also be a key area of infrastructure to invest in. Bank XYZ Digital will need to ensure that customer information is protected, especially as a digital bank, where everything will be maintained an accessible online.

QUESTION 3

i. Outline the five broad areas of risk that banks manage [5]

- Credit risk: the risk of loss arising due to non-performance of a counterparty in a credit agreement

- Market and interest rate risk: The risk of losses arising from adverse movement in the market prices of financial instruments

- Operational risk: The risk of losses arising due to adverse operational events

- Liquidity risk: The risk of not being able to meet cashflow obligations

- Capital and balance sheet risk; The risk of not meeting solvency/ minimum capital requirements

ii. Provide four examples where models are typically used to quantify and manage these risks in a bank, outlining:
   a. The typical model form and
   b. The adverse consequences of model failure in each example. [10]

- ECL models used for the quantification of expected losses for the purposes of financial reporting and management information

  - These models typically have the form of PD x EAD x LGD where:
    - PD is the estimated default probability over a defined horizon
    - EAD is the estimated exposure at default of the associated default event
    - LGD is the estimated loss given default post the associated event

  - Errors in these models could lead to mis-statement of financial results leading to a loss of credibility in capital markets

  - Errors in these models could also result in management making inappropriate decisions with respect to loan originations and portfolio management

- RWA models are used for the purposes of producing regulatory capital returns and the minimum Pillar 1 capital levels. These Pillar 1 capital levels are based on estimates of tail risk using methods determined by the regulator

  - Typically, these models have the form of PD (99th percentile) x EAD x LGD (downturn) where:

    - The PD (99th) is a stressed PD typically formulaically derived from the bank's through the cycle PD estimate over a 1-year horizon
    - EAD is the estimated exposure at default for the associated PD event
    - LGD (downturn) is the estimated loss given default for the associated default event in an economic down-turn

  - Errors in these models could lead to mis-statement of regulatory returns

  - Or holding the inappropriate amount of minimum required capital levels. Holding too little capital could lead to bank failure in the event of stress and holding too much capital is consider inefficient and could limit the bank's ability to grow.

  - In turn this will lead to credibility concerns with the regulator and possible capital add-ons

- Models used to monitor aggregate net exposure in the bank's trading book

  - Typically, these models estimate how much the set of investments may lose in normal market conditions over a set period (typically one day) with an associated probability and has the form:

    - Probability of exceeding "value at risk" over a set period
    - Where "value at risk" is typically defined to be some absolute or relative loss level for a set of investments

  - Errors in these models could result trading risk being under-estimated leading to volatility in returns outside of the bank's risk appetite

- Rating models are used to estimate credit risk inherent to lending transactions at origination

  - These models typically have the form PD x EAD x LGD with PD, EAD and LGD being best estimates for the inherent risk in the transaction over the transactions' estimated horizon
  - Often the PD estimate is derived from an intermediate ratings model that classifies the counterparty into a credit rating

- Errors in these models could lead to on-balance sheet transactions that are riskier than the appetite of the bank being concluded (errors under-estimating risk) or restrict deal-flow (over-estimating risk)

- Other models also eligible for marks: (operational risk quantifications, pricing models, budget/ forecasting models, ALM models, fraud identification models, economic capital models)

iii. Outline model risk and its sources with examples [12]

- Model risk is the risk of loss resulting from incorrect decisions due to incorrect model results or incorrect interpretation of model results

- <u>Incorrect model, or model form</u>. Model results may be incorrect if the choice of model form used is not appropriate to the problem under consideration.

  - Examples are:
  - the use of analytical solutions, like Black-Scholes to price illiquid positions
  - Insufficient granularity of number of model parameters that leads to unidentified risk changes, e.g. a mortgage LGD model that does not consider Loan-to-value ratios
  - Model applied to make decisions outside of original development scope

- <u>Incorrect parameter estimation.</u> Model results may be incorrect if the data used to estimate input parameters is incorrect or if the reference experience is not appropriate for use over the projection period (the future will not be as the past)

  - Examples are:
  - the reference data may be incomplete (i.e. not contain all exposure and event records) or no longer representative of the model objective
  - the refence period may be set in macro-economic context (turbulent of benign) that is not likely to be repeated over the projection period
  - Biased expert judgment applied
  - Overfitting on sparse data

- <u>Errors in implementation.</u> Model results may be incorrect if the model implementation is flawed. The errors may be due to calculation errors, or data input and/or transformation errors

  - Examples are:
  - At implementation sign-errors may be present. E.g., using a negative sign instead of positive
  - The model may require an input denominated in the local currency but receive values denominated in another currency

- Errors in interpretation. Model results may lead to financial loss if the outputs are mis-interpreted
    - Examples are:
    - Use of through-the-cycle loss estimates to do near term financial planning
    - Interpreting a credit rating for a short-term horizon to price a long-term exposure
    - Use of open-market valuations to estimate losses in distressed sales scenarios

- Under-estimation of the uncertainty inherent in model results. Models are approximations of reality and the extent to which the best model may over- and under- estimate risk needs to be considered in context of the firm's risk appetite
    - Examples are:
    - Large oil-and-gas project finance will rely on modelled oil prices and currency movements. The variability and correlation between these metrics and its impact on the viability of the loan needs to be understood
    - Reliance on valuation models in property finance needs to consider the likely model variance inherent in property value estimates

- Model complexity. Models that are over-specified (too many parameters) may yield spurious results and exacerbate parameter estimation and implementation errors.

    - Examples are:
    - Rating systems with input variables that show high levels of correlation
    - Forecasting models that project future cashflows at retail exposure level that included macro-economic drivers also at the individual exposure level

iv. Outline the key considerations in establishing a model risk governance framework. [8]

The governance framework should:

- Ensure an accessible and practical model risk management policy is in place

- require a model inventory, and therefore by implication, what is considered/ defined as a model.

- Identify and articulate clear roles and responsibilities for all aspects of model management

- Specific roles are:
    - Model owner- the individual responsible for model outputs and their application in business

    - Model developer- the individual responsible for model choice, parameter specification and parameter estimation

    - Model validators- the individual responsible for independent replication of results, methods and assumptions as applied by model developer

    - Model custodian/ model implementation specialist /implementation owner- the individual responsible for model implementation and execution in everyday use

- Ensure models need to be subjected to meaningful evaluation, validation, monitoring and challenge through a transparent and accessible process that connects subject matter experts with model owners.

    - For example: the framework could establish a committee that facilitates model approval and monitoring on a regular schedule:

        - This committee needs to comprise of subject matter experts

        - Needs to have access to resources to perform independent validation (or commission these activities)

        - Ensure record of model owners, developers and validators and monitoring reports are current

        - Monitor, raise and clearly describe inherent model risk trends in the firm