EXAMINATION

October 2021

Subject F206 – Banking Specialist Applications

SOLUTIONS

QUESTION 1

You are a consulting actuary working for Turn-It-Around Consultants and Actuaries. LendiT Bank has requested your services to assist them with substantially improving their business.

LendiT is a pure retail bank, using only retail deposits for funding and the only credit product they sell to the market are retail loans of less than R50,000 (micro loans). LendiT's financials for the last 5 years have been fully audited by a credible audit firm and they have provided assurance that all monies flowing into and out of the microlender have been accurately accounted for. In addition, they state that all IT systems are fully operational from a technical perspective.

LendiT has a R12bn portfolio which is the 3rd largest market share in small retail loans (micro loans). In the 2019 calendar year, it generated a loss of R50m and in 2020 it generated a loss of R65m.

i. Explain what information each of the following financial metrics, as derived from a bank's financial statements and financial disclosures, provides:
   - ROA (return on assets),
   - Cost to income,
   - Bad debt charge to assets,
   - NIR (non-interest revenue) to assets and
   - NII (net interest income) to assets. [5]

- *ROA: the return on assets will compare the final profits (per product or the bank overall) relative to the total asset portfolio of the bank. This measure shows the effective return achieved on the assets and allows comparisons across products to understand which products are contributing proportionately more to profits and how this compares to their relative risk. This will allow an institution to focus more time and energy on the more profitable lines of business (or where to improve profits and less profitable lines or optimise profit for a given level of risk).*
- *Cost to Income: this measure compares the total costs to the total income or revenue generated by a product (or a division or the entire bank). It allows cost comparisons across the industry and within the bank across the product line to see the relative amount of costs required to generate a certain amount of revenue. It assists the bank to identify areas that are more costly to run, either for possible downsizing or to search for operational efficiencies in that area*
- *Bad Debt Charge to Assets: This shows the percentage of assets either lost to bad debts or expected to be lost to bad debts over the relevant financial period. Tracking this percentage is one of the key metrics for credit risk management and the bank will always be looking to keep this number as low as possible relative to its ability to price for the risk of these losses.*
- *Non-interest revenue (NIR) to Assets: this measure shows the additional revenue generated off the back of fee income on certain product lines and shows it as a percentage of the assets in that product line. This allows the bank to see proportionately how much any fee income is contributing to income across product lines and where it generates relatively significant additional value.*
- *Net interest income (NII) to Assets: This is a comparison of the interest revenue less cost of funding to the assets of the product line (or bank overall). It shows the relative revenue generated from banking activities related to the maturity transformation of funds alone before allowing for any additional fee revenue, running costs and bad debts. It shows where there are larger or smaller margins available to the bank to cover other operational costs off the back of the interest rate pricing. This metric is influenced by the margin on advances, the mix of liabilities, especially between interest bearing and equity liability and the cost of this funding.*

ii.   Describe how you would evaluate the following aspects of the business to inform the recommendations you would make to LendiT Bank:

   a.   Financial results and standing   [8]

Financial results and standing

Candidates need to reflect on the impact of Covid on FY 20 results and balance sheet impairment ratios

Obtaining a detailed understanding of the financials of LendiT Bank would be a good starting point to identify where possible gaps and opportunities are. The financials give the overall picture and allow a detailed breakdown of all aspects of the business, from a cost and revenue perspective.

There is no guidance given as to exactly where the company is going wrong from a financial point of view and why the results look poor. All we do know is that the financials and systems are all technically correct so we can rule out system errors and reporting inaccuracies as a result.

The ROA (return on assets) from 2020 = -R65 m / R12,000 m = -0.54%. So, the losses relative to the book size are not large (which means a small set of adjustments to pricing, collections, costs may be sufficient to at least allow the bank to turn a profit over a short space of time).

- *There is also no indication given as to how LendiT's financials looked in prior years (2018/2017). These periods may have been profitable, but may also have been significantly worse off (so perhaps some turnaround strategies are already in place and the financials will look positive in 2021 without too many additional adjustments)*
- *Several financial ratios can be calculated using these financials to give a starting point to identify possible opportunities to assist with finding the biggest concerns within the business first (so that these can be prioritised). It will also allow the ability to track trends and changes over time which may also pinpoint past issues and concerning trends over time*
- *A peer comparison can be done across the financial ratios using the financials of other similar microlenders. In addition, sub-sections of financials of larger full-service banks can be used too. This will help to identify outliers in terms of the financials relative to peers with similar portfolios. This comparison may help to identify what might be deemed as "easy wins" in terms of improving the financials*
    - *It may also highlight if peers are running at a loss on similar portfolios, which may be because of economic conditions or competitiveness, and this would help to guide the business in terms of what financial results are acceptable or possible in the operating environment*
- *A peer comparison can also be done (high level) by looking at the Prudential Authority returns, and Pillar 3 disclosures returns submitted by peers to compare LGD's and PD's across the business. Although these are more long-term assumptions it may still provide some guidance in terms of book performance from a credit loss perspective (there may be more detail on assumptions sitting within the models)*

Profitability Analysis Using Financials:

- *At a high level, profit is a function of:*
    - *Gross Interest Revenue – Cost of Funding (- ISP) + Fee Income (NIR) – Running Costs – Bad Debt Charge*
    - *Each of these elements should be scrutinised to identify areas of improvement or opportunities to enhance the results of the bank*

- *Gross Interest Revenue: is the interest income that in this instance is earned from the loans that have been paid out and is the result of the pricing strategy of the bank. Some of this income may not be realised because of bad debts (suspended interest on stage 3 advances*
- *Cost of Funding: this is the cost associated with borrowing money (from funders or in this instance depositors) and is the total monies paid out to these funders to compensate them for allowing the bank to utilise this funding. Since the bank is only making use of retail deposits for funding (at this stage) this cost will be a function of the rates the bank is offering on its deposit book.*
- *NIR or Fee Income: this is additional revenue earned because of any fee income charged on the loan (or deposit) portfolios (monthly account fees, initiation fees, credit life fees)*
- *Running Costs: these are the costs associated with running the banking operation from end to end. It covers elements like staffing costs, building rental, branch costs, ATM running costs, maintenance of systems*
- *Bad Debt Charge: this is the cost of the losses incurred because of defaults occurring on the loan book. It is calculated over the period as total provisions raised less total provisions released plus write-offs (of loan balances) less any post write-off recoveries made*

[3 marks available for fair explanations of elements of the income statement]

- *Credit for evaluation of balance sheet capital and liquidity ratios equally valid*

    b.   Strategy, operating model, and operating environment   [9]

Strategy, the operating model, and environment

Candidates need to reflect on the impact of Covid on FY 20 retail sub-sector and the bank's own operations. Alternative sources of funding also important to consider.

Review of the strategy:

- *Research into LendiT's current target market for loans and deposits should be performed to get a better understanding of the market size and opportunities. This will help to establish whether these markets are growing or shrinking and if there are additional opportunities to expand the business into different segments that have been previously excluded*
  - *LendiT will probably have a brand and market perception that would have been created because of previous strategic focus. Any change in target market would require significant investment in brand perception and service offering.*
- *Evaluating the deposit and lending products against competitor offerings available to the target market to evaluate relative attractiveness of the current mix available*
  - *The relative level of competitiveness will be important to understand to gauge opportunities for growth and repricing where required*
  - *The products offered should also be evaluated to see if there are opportunities to expand these (more types of deposit products, larger loan amounts, longer terms) to expand the opportunity*
- *Evaluating opportunities to expand the banks overall product offering to diversify across other portfolios and sectors (for example offering secured lending, credit cards, cheque accounts)*

- - *This would help with diversification of revenues across more products and thus improve the likely stability of profits over time (especially for fee generating products like cheque accounts)*
    - *It will also allow the bank to expand into additional market segments more easily as they will become a more full-service bank*
- *Evaluate the distribution channels LendiT uses and how these distribution channels compare to competitors in the target markets*
    - *This will allow the bank to explore additional distribution channels (to increase market share) or to put more focus into channels that are more efficient from a cost perspective*
- *Evaluate the emergence of any substitute products that the target market may be availing of, for example store- credit*

Review Operations and Processes:

- *The overall operating model of the bank should be reviewed to understand if there are any opportunities for the bank to reduce running costs over both the short and medium term to improve the financial situation*
    - *Headcount numbers overall and how this is distributed between frontline staff and support functions – the bank may be proportionately overstaffed in certain areas where headcount can look to be reduced*
    - *Operational network: numbers of branches / ATM's / digital presence / contact centres / head office size and location; to understand how large this network is and to see if it is operating effectively and making good use of this network*
    - *A review of the usage of all the customer facing facilities should be performed, and relative cost to revenue analyses should be performed across them to allow the bank to identify specific ATM's / branches that could be downsized/closed with limited customer and revenue impact*
    - *The bank should ideally be working towards a digital strategy and customer engagement model (as this sort of model is typically more cost effective than having a large physical operational footprint). It would be worthwhile investigating how digitised the customer base is and if the bank has set up some rails to move to digital platforms (and how far along they are) – for example an App / Online platform. Rolling this out more extensively in the customer base will certainly assist with driving down costs*
- *The banks operations should be compared to peers that are running a similar type of model to identify areas where there are significant outliers (for example if their branch network is relatively large compared to peers, or their cost base is disproportionately large). This would immediately point to there being some level of opportunity to improve on this element of the business*

Review Operating Environment:

The overall economic situation needs to be considered when reviewing the current financial situation and proposing amendments to the business model:

- *Sectors of the economy may still be struggling currently due to lock-down measures (e.g. tourism). This will result in credit risk being elevated. If the expectation is that this will improve over coming years, then the results of the bank will potentially improve purely off the back of an improved economy*

- *Evaluate how the current client base of LendiT has been impacted, relative to competitors, and relative to the available market of depositors and debtors.*

     c.   Pricing methodology   [8]

Pricing methodology

The analysis of the financials and the financial ratios can assist with the review of the pricing methodology and can help the business to ensure that the pricing is accurate and sufficient for the bank to turn a profit.

- *To understand how the interest revenue and funding cost lines are being generated in the business and what is causing the current ratios seen, one needs to review the pricing methodology that has been implemented by the bank*
- *There are two main sets of products that the bank makes use of in the day to day running of the business. Both should be reviewed to ensure that they make business sense and are both competitive. They also need to provide the business with sufficient profits / revenue relative to the costs and risks involved*
- *Lend Products:*
  - *The main revenue driver for the bank is the loans product that the bank currently provides. The pricing methodology and assumptions used for this product need to be requested from the credit or pricing team. Both the current pricing model as well as previous models along with changes to the models (for the past 3 or 4 years) need to be supplied to allow for a full review of past and current pricing to be performed*

  - *The assumptions used (for cost of funds / running costs / bad debts) need to be compared to what the bank is experiencing on the book (to ensure that these have been correctly stated in the model)*
    - *Running costs and cost of funds can be easily compared and reviewed as these figures can be created directly off the income statement relative to the total asset or book size (for a high-level estimate)*
    - *However, the bad debt experience and the amount to be priced for has many moving parts and while at a high level a comparison of the bad debt charge to the total book value will give some guidance, a proper review of the application scorecard would be worthwhile*
  - *These outflows in the income statement need to be compared to the fees and interest rate revenue that are due to be charged (ideally per risk bucket) to ensure that the bank is at least pricing sufficiently to make a profit when pricing the product at inception*
  - *If this is not the case currently, the bank will need to review its current pricing and look to increase rates/fees where possible for the portions of the portfolio where the loans are loss making*
    - *If there are certain risk buckets where the bank cannot price for risk and will run at a loss, the bank would need to consider significantly reducing the exposure to these sub-groups*
  - *There needs to be a close alignment between the pricing on the credit products (from a funding or FTP perspective) and the current and future pricing on the deposit book of the bank. If the bank has priced the deposit book too aggressively (i.e. offering exceptional rates to attract large volumes of deposits), then this costing will to some*

extent need to be passed onto the customers making use of the credit products of the bank

- o *Unfortunately, if the bank is currently mispricing this product (or was mispricing it in previous financial periods) then not much can be done to rectify the back book profitability (from a pricing perspective – some operational changes may reduce the income statement outflows though which will assist from a profitability perspective)*
- o *However, by pricing effectively and profitably on a forward-looking basis the bank will slowly start to turn the financial results around over time (depending on the speed of the churn on the back book this may occur within a year or two)*
- o *Pricing should also be compared to peers to get a sense of what their peers are charging and to understand how much realistic scope there could be for pricing changes (without losing significant market share)*
- o *Any indication that the target market expects keener pricing that what the operating costs or bad charge expectations allow then entire business model requires an urgent review*

- • *Deposit Products:*
  - o *No indication is given as to the types of products currently available to the retail customers banking with LendiT. One can assume there is some mix of overnight deposits and fixed / notice deposits. This mix of products and their contribution to the total funding portfolio needs to be shared as different turnaround strategies would be implemented for different parts of the portfolio*
    - ▪ *For example, for overnight deposits if there is a requirement to adjust the interest to be earned by customers this could possibly be implemented in the short term (with some simple communication to the impacted clients), while for fixed-term or notice products the rates agreed to re probably fixed till maturity*
    - ▪ *The maturities of the notice deposits also need to be shared, and the average interest rates to be paid to customers, so that there is an understanding of how long any pricing changes may take to work their way through the deposit book*
  - o *The pricing schedules applicable to the full suite of deposit products must be obtained from the relevant product owners, ideally both the current pricing schedule as well as the pricing applied to these products historically. Both interest offered and any fees payable on the accounts would be important.*
  - o *The historical pricing or pricing of products on the book could be gleaned from the system hosting the deposit products too (where rates are likely to be one of the fields in the database, along with remaining tenure for fixed or notice period type deposits)*
  - o *The rates offered should be compared to peers in the market offering similar products, again to gauge price competitiveness and the understand if there are any products where the rates offered are far too generous (resulting in funding costs that cannot be passed onto the lending book in totality). There may have been some good reasons for offering more generous rates (to encourage deposits). This may result in funding generally being more expensive for this bank*
  - o *Alternative funding options could be explored to establish whether the bank could find some source of cheaper funding and thus include this in the mix to decrease the average FTP across the book. However, retail deposits are often the cheapest (and most stable) source of funding.*

Asset and Liability Matching:

- *The total assets and liabilities need to be compared to ensure that the bank is making the most effective use of the funds that it has in place and that as far as possible it is matching and optimising the relationship between the two*
- *The maturity profile of the deposit book and the maintenance of required liquidity ratios under all scenarios needs to be evaluated*
- *The tenure of the lending and funding books should be compared to ensure they are reasonably aligned (as if the tenure of the funding book is significantly longer, likely the bank is having to pay a premium for this additional tenure – especially for notice type products). This will result in funding on average being more costly for the bank relative to peers*
- *The bank must also ensure it is making sufficient use of its available funding and does not have too much unutilised funding sitting within the institution. For example, if the loan book is R12bn in size, and the deposit book is R17bn in size, is the bank making effective use of the R5bn spare funding (investing it at a decent rate for example) to ensure that on balance the COF charge to be covered by the loan book is not further increased to cover any shortfall of returns made on excess funding*

  d. Credit risk models and credit outcomes   [12]

Credit risk models and outcomes

The credit risk outcomes of the business are a key driver of success and profitability overall. Especially for an unsecured loan portfolio where credit losses are likely to be a large percentage of the total loan book. Ensuring that the credit risk is accurately estimated (to allow for correct pricing), is optimised and reduced as much as possible will fundamentally transform the results of the bank overall.

New business performance:

- *Key risk metrics need to be evaluated to determine whether they are effective in giving management insight and/or early warning on any adverse deterioration in credit performance*

- *A review of the bad debt performance (especially the default rates) needs to be made especially with respect to the application scorecard and its predicted levels of default (which would be used for pricing amongst other things)*
  - *The default vintages through the lifetime of the loans need to be analysed to look for any peaks or unexpected trends that occur) to ensure that the pricing allows for these trends*
  - *In addition, these must be compared to the application scorecard predicted vintages per scorecard/risk bucket to ensure that there is reasonable alignment, and that the scorecard is allowing the pricing to be fairly accurate and reasonable per risk segment*
  - *The Gini or ranking ability of the scorecard needs to be reviewed, both currently and over time, to ensure that it is working consistently and effectively over time. If these measures have been deteriorating over time, or if the Gini is just poor relative to industry standards, then a rebuild of the application scorecard should be considered*

- *It would also be valuable to see if the default experience has been changing over time (again per risk bucket) to understand if there are specific sub-populations that are experiencing a*

deterioration and if this warrants some strategic changes to the loan offering for these customers (smaller loan amounts, shorter loan terms, tighter affordability buffers applied) to reduce the risk mix of new customers being onboarded

- *The credit offer matrix (loan amounts and terms by risk bucket) currently applied by the business should be reviewed as part of this overall risk review to ensure that it makes business sense and that it is allowing the right mix of business to be brought onto the book over time*

Review Impairment Policy:

- *One needs to request the current provisioning methodology and model in use by LendiT Bank to review the following elements of the model*
  - *Provisioning methodology used:*
    - *Presumably IFRS9 since it is a South African bank*
  - *Assumptions / Parameters used within the model:*
    - *The PD / LGD / EAD assumptions used within the model must be scrutinised to ensure that they are a fair reflection of reality and are not overly conservative (or are understated)*
    - *These parameters should be recalculated to ensure that are statistically and financially correct and to ensure that they have made allowances for all cashflows occurring in the business (for example in LGD ensuring that post write-off recoveries are correctly allowed for)*
  - *Staging Methodology:*
    - *Review the staging rules created and applied by the bank to ensure that they are in line with the spirit of the accounting regulations and are not overly conservative*
    - *In addition, one needs to ensure that they have been correctly applied in the business and that there are not coding errors that have resulted in an overstatement of customers rolling into stages 2 and 3*
    - *Review the rules applied within the model with respect to curing out of arrears / SICR to identify if these accounts are provided for at a reasonable level and to see if curing rules are not too conservative both in terms of treatment within the stages as well as coverage ratios*
    - *Review the SICR model that has been developed to identify significant deterioration in credit risk to ensure that it is sound and does not accidentally result in an overstatement of stage 2 arrears*
      - *Review the economic variables utilised (there may be one or two that have changed significantly resulting in many more SICR rolls into stage 2, but the underlying risk is stable)*
      - *Review the initiation PD that is used as in comparison to the updated SICR PD (if the pricing model PD is understated or does not rank bad customers well, then there is a risk of many more customers rolling into stage 2 however this is as function of a weak application scorecard and not necessarily poor risk coming onto the books)*

  - *Where possible the methodology and model inputs and balance sheet impairment coverage ratios should be compared to peers to ensure some level of consistency (as far as is appropriate) as this will help to identify if the bank is an outlier for some reason and may highlight easy adjustments*
  - *Write-Off Policy:*

- Review the write-off policy with respect to how many months in arrears a customer needs to be and for how long before a debt will be written off (and compare to peers within the industry). If this policy is too conservative, then losses will be recognised too early, and this will result in an overstatement of the bad debts medium term (however longer-term post write-off recoveries will come back into the financials)
  - Any additional overlays that have been created in lieu of either perceived shortcomings in the models currently in place or in lieu of economic risks that the bank is aware of down the line that they believe warrant such overlays
- There is the possibility that the bank is currently creating provisions that are overly conservative and will thus result in the financial profitability of the bank being understated. Although this would eventually balance out and result in provision releases (effectively an overlay has been created that would be released) the timing of the profits relative to their realistic realisation would be incorrect and unfair on investors
- It is only reasonable and fair to hold deliberate overlays that can be articulated as such within the financials to create a fair view of how the bank is performing
- The provisions could also be understated or incorrect resulting in even larger provisions and bad debts post the review, however, this review is important to complete in any case to ensure that the calculations are indeed fair and accurate
- It is important to have insights into the external audit partner's report on the evaluation, reasonableness, and inherent caution in the impairment results

Review Collections Process:

- As part of the review the current Collections process also needs to be reviewed to understand how this can be enhanced to reduce arrears and defaults, and in addition to see how the bank can more successfully collect on arrears and post write-off recoveries. Where possible the banks practices and collections rates across the stages should be compared with peers (stats may be available for example from external debt collection agencies or credit bureaus to run these comparisons)
- Reducing / slowing down arrears:
  - The standard collection/payment methodology should be reviewed to ensure it is as effective as possible:
    - How does the bank collect payments: automatic debit orders or direct deposits?
    - Does the bank make every effort to align collection dates with salary dates of customers (by both aligning to pay dates as well as making allowances for holidays/weekends etc when running billing)
    - Is the billing process/submission of debt collection files running smoothly and timeously each month or are there at times delays/errors that result in poorer than expected collections
    - On the collection of the first installment, does the bank give itself (and the bank setting up the debit order) enough time to initiate all the relevant processes (or does the bank experience poor first payment defaults). First payment default may result in large portions of the book unnecessarily rolling into stage 2 in the provisioning model
  - Does the bank run any trigger messaging to remind customers of upcoming payments due (especially for higher risk customers / customers paying via direct deposit)?
  - Are there sufficient early warning triggers and reporting in place to act on early missed payments? Does the bank allow customers for example 5 days to rectify a

missed payment or does the bank initiate a conversation early on (for example a reminder txt message of the missed payment)?

- *Improving bad debt recoveries:*
  - *Once a customer goes into arrears / default / is written off, there are different strategies that can be put in place to assist with collections and help to improve overall recoveries on these debts:*
    - *Does the bank collect on its own customers for all levels of arrears or does it outsource some of the collection efforts to EDC's (external debt collection agencies)? If the bank does not use EDC's, it is something the bank could include in the collection efforts to see if EDC's may be better at making collections for certain risk segments and buckets*
    - *Likewise, the bank could look to bring some Collections efforts back inhouse if they are currently making use of EDC's that are either ineffective or are more expensive to use relative to others*
    - *Does the bank seek judgements on the debt for larger outstanding debts (where it makes financial sense to do so)?*

[Total 42]

QUESTION 2

TechBank is a large bank that offers a full suite of Retail and Non-Retail products. TechBank prides itself on being at the cutting edge of innovation and technology and often introduces new products and technology to the market. The CRO of TechBank has asked you to write a short report detailing the potential benefits of adopting new technologies such as Artificial Intelligence (AI) and Machine Learning (ML) to better manage their credit and other risks.

AI seeks to complete human intelligence tasks. ML is a subset of AI that seeks to make applications more accurate in predicting outcomes without having to be specially programmed.

i.   Briefly discuss the potential advantages of using AI and/or ML in managing risk.

[7]

The potential advantages of AI / ML are as follows:

Automation of processes

- *AI and ML can be used to automate repetitive human tasks in the risk management or operational process.*

- *Automation of these manual tasks would reduce the risk of human error, which may result in increased confidence in the results, and better overall risk management in the organisation.*

Integration of Risk Processes

- *AI can be used to better integrate processes across the risk management cycle, especially at client and contract initiation (credit approval, Anti-Money Laundering (AML) and Know Your Customer (KYC) requirements), loans disbursement, ongoing risk monitoring, collections, and provisioning. Integrating data driven decision models to reduce the number of hand-offs between teams should reduce human error and time delay.*

- *This reduces the amount of manipulation of manual data required as part of the "ETL" (extract transform load) process OR manual retrieval of case-by-case data*

- *AI and ML can result in faster credit and fraud decisioning (real time decisioning) for the approval process. Instead of relying on traditional methods and processes, alternative credit scoring models can be used to assess the credit worthiness of potential and current clients.*

- *Disbursement processes can be accelerated using multiple channels for loan disbursement. Especially to the extent that AI and ML routines can be used to accurately interpret images and/or biometrics and/or audio transcription for identity and document verification purposes*

Scalability and Flexibility

- *Models that make use of AI and ML are expected to be more scalable/flexible than traditional models in dealing with portfolio, data, external changes.*

- *For example, AI / ML techniques may make better use of the existing data points (e.g. creating structured data from unstructured data) and are also more readily able to incorporate new data points in an automated way (continuous and automated re-training as governed by the human expert).*

- *These alternative models should therefore be more future proof, requiring fewer redevelopments and manual recalibration in keeping up with changes in lending criteria together with industry developments.*

- *These benefits are dependent on the data and information technology platform's ability to facilitate the flow of data*

Anticipation of future client needs

- *AI / ML approaches can be used to predict future credit needs of obligors by analysing historic credit use and identifying relationships that are not easily identifiable using traditional techniques.*

- *This would enable Banks to make predictive and proactive lending decisions, offer further cross-sell and upsell opportunities to their existing customer base.*

- *For example, it can help in identifying customers that are predicted to have large expenditures (and hence demand for additional credit) at a certain time of the month based on historical data and expenditure trends.*

- *This would allow the Bank's lending team to provide a more tailored and targeted approach in dealing with the needs of their customers.*

Accuracy

- *Due to more sophisticated modelling techniques, AI / ML may improve the accuracy of credit and fraud risk models when compared to traditional methods.*

- *As the approaches rely on continuous incorporating of data and trends, and more regular / automatic recalibration, AI / ML models can be used to uncover new patterns previously unexplained to further improve the accuracy for credit decisioning.*

- *Even in areas where regulatory approval may not permit the use of AI / ML models (e.g. capital reporting), AI / ML can be used to supplement traditional models to improve the accuracy of credit risk decisioning.*

ii.   The CRO recently met with the CEO of a large South African Telco to discuss the potential use of alternative data sources, such as Telecom data, to enhance the AI / ML models further. Briefly discuss the advantages of using alternative data in credit risk modelling.

- *AI/ML models can more easily incorporate unconventional data (such as Telco data) or publicly available data (such as Social Media data) to the extent that it can interpret non-traditional data formats and "unstructured" data*

- *These alternative data could be used to enrich credit models, thereby helping to identify early warning signals of increased credit risk.*

- *The bank's understanding of a household's financial needs can also be enhanced using alternative data.*

- *This is because conventional data may not capture all information related to spending habits, income, and other behavioural aspects such as type of expenditure.*

- *By using a combination of available historical and current data, the Bank can perform predictions that are more unbiased, reliable, and accurate when compared to internal banking data only.*

- *This would result increase accuracy of credit risk models*

- *Which would increase the ability of the front office and marketing teams to use a more targeted sales approach for banking products.*

- *Alternative data can also be used to expand the Bank's market segment to client segments with limited traditional credit information (for example unbanked populations).*

- *This can help achieve the objective of better financial inclusion.*

- *The use of alternative data is not yet widely accepted, and customers may not like the idea of the Bank using external data perceived as personal in the assessment of their credit quality*

- *Furthermore, the bank would ultimately then become responsible for data protection of these additional data, and so would need to ensure that they can comply with the relevant regulations.*

iii.   Before asking the modelling team to incorporate these new techniques (AI/ ML) and Alternative Data in its credit risk modelling, the CRO would like to understand the main challenges of using AI / ML models and Alternative Data to support business decisions. Outline these challenges, as well as ways in which they can be proactively mitigated.

[10]

Insight into the workings of AI/ML models

Challenges

- *AI / ML models are generally perceived as "black boxes" as the methods and relationships identified are more difficult to explain than for traditional credit risk models.*

- *This also means that traits such as fairness, privacy, reliability, and causality may not be clearly identified and explained in AI / ML models and so may result in bias in decisioning making.*

- *As Bank's act to serve the population through driving the financial activity in the economy (lending, deposits, etc), management's understanding of their business practices and decision*

is a requirement in the industry as they need to be accountable for the decisions that they have made.

- *Given the difficulty in being able to interpret these models and how they inform management decisions, there is currently limited applicability, especially in areas such as provisioning or capital.*

Mitigations

- *Banks can make use of model-agnostic interpretation methods.*

- *This involves separating the explanations from the machine learning model into components that allows for contrastive explanations. Instead of comparing a prediction to the average prediction of the entire dataset, a comparison can be made to a subset or even a single data point, thereby providing an explanation with a reasonable foundation in outlining the various factors that led to a decision by AI/ML in a credit scoring model.*

- *Banks can also use these AI/ML models as "challenger models" as a check against, or even to supplement, the results produced by the existing models.*

- *In this way, decisioning can be enhanced by the alternative model, however the outcome being determined by a traditional model which can be interpreted and explained.*

Data quality & bias

Challenges

- *AI/ML models tend to be more sensitive to the data used in their development and calibration.*

- *As a result, they require sufficiently large and comprehensive datasets to be trained appropriately.*

- *Like traditional models, the results of the decisions made by AI/ML in credit scoring are dependent on the quality of data used.*

- *As these models tend to be more automated, data errors or biased data may not be identified and therefore included in the models.*

- *This could result in decisions that could be misleading, or which negatively affect the overall decision-making process.*

- *Due to the difficulty in interpreting AI/ML models, setting appropriate reasonability checks on the results (or stages in the model development process such as variable selection / intuitiveness of relationship) obtained is a challenge.*

Mitigations

- *Banks should ensure that their overall model risk management includes allowance for AI / ML models.*

- *Data risk and data quality risk should be included as a separate dimension of risk in the model risk evaluation process. In this way, there is a proper process of addressing the data risk posed and ensures that these risks are following (compliant) existing data regulation.*

- *Where possible, the model risk management process should also incorporate manual checks that would be found in traditional model recalibrations, such as reconciling data and comparing it with past results, to ensure that the results obtained are in line with expectations.*

Regulatory scrutiny on the use of Alternative Data

Challenges

- *Despite more Banks making use of alternative data, there is limited regulation at present (both globally and in South Africa).*

- *However, given the emphasis placed on regulation relating to ensuring the financial soundness of the Banking industry, there is likely to be increased scrutiny from regulators soon as more Banks look to incorporate alternative data sources.*

Mitigations

- *The use of additional (and relevant) customer data can help strengthen the existing risk management process of the bank by incorporating factors not previously captured.*

- *Banks can also establish enhanced data governance to ensure the usability and integrity of the data before they are incorporated into the models.*

- *Using the data quality and information management principles embodied in BCBS239 would provide good guidance for enhanced data disciplines*

Ethical considerations

Challenges

- *Loan decisioning may be exposed to the risk of unfair discrimination, in the form of differentiating credit risk based on identity characteristics, such as race, gender, and sexual orientation.*

- *This risk is exacerbated as much of the data that would be used to train the AI / ML model could be biased in its nature.*

- *For instance, if a biased set of historical data is used to train the AI/ML model, this bias will be incorporated as the algorithms will be built on these biases. Should these biases not be corrected, prejudice in credit decisions may be applied going forward.*

  For example, there have been studies that have shown samples of loan data for women are usually smaller as compared to men, as Banks have approved fewer and smaller loans to

women in recent decades. This has knock-on effects on how algorithms are built based on the data provided, and subsequently on how the data is interpreted for female applicants.

Mitigations

- *Inherent data biases should be removed during model development to prevent false inferences.*

- *AI/ML models can be used to identify patterns where inequalities appear in raw data. Checks and requirements can also be put into place to ensure that unfair discrimination is not possible (for example to remove race data from the calibration set).*

- *Outcomes for the model use-cases need to be evaluated to ensure that the model did not incorporate some unidentified proxy for identity features which may lead to unfair discrimination (e.g., address information in segregated communities)*

[Total 22]

QUESTION 3

i.   State what the main aims of IFRS9 are.

  - *IFRS 9 is an International Financial Reporting Standard published by the International Accounting Standards Board.*
  - *It addresses the accounting for financial instruments.*
  - *It contains three main topics: classification and measurement of financial instruments, impairment of financial assets, and hedge accounting.*
  - *The standard came into force on 1 January 2018, replacing the earlier IFRS for financial instruments, IAS 39.*
  - *IFRS9 aims to simplify the accounting for financial instruments and address perceived deficiencies of previous standards which were highlighted by the financial crisis.*
  - *Classification and measurement of financial instruments follow a more principle-based approach under IFRS 9 than under IAS39.*
  - *IFRS 9 applies a single impairment model to all financial instruments subject to impairment testing while IAS 39 prescribed different models for different financial instruments.*
  - *Impairment losses are recognized on initial recognition, and at each subsequent reporting period, even if the loss has not yet been incurred.*
  - *In addition to past events and current conditions, reasonable and supportable forecasts affecting collectability are also considered when determining the amount of impairment in accordance with IFRS 9.*

[5]

United Africa Bank (UAB) is a medium sized bank that operates across several African jurisdictions, offering retail lending products. The bank's model validation team is about to commence its annual assessment of its key IFRS 9 models. However, the head of the validation team is aware of the effect of COVID-19 on on-going model performance.

ii.   In particular, the head of validation is concerned about the effect of payment holiday programmes that have been offered to customers. Discuss the key aspects to be considered in the validation, and how some of these may be dealt with.

Note: Discussion regarding the Forward-Looking models are not required for this part of the question

[14]

Scope and nature of payment holidays, systems, and data

  - *It would need to be determined whether the payment holidays have been offered to all customers and applied automatically, or whether it was a voluntary scheme and therefore only affected those customers that took up the scheme.*

  - *Similarly, an assessment would need to be made as to whether the payment holidays were applicable to all portfolios and customer segments (Retail, Non-retail, Secured, Unsecured), and whether the terms of the payment holidays were consistent across these portfolios and segments.*

- *The period of support would also determine the extent of implications when it comes to model validation. Shorter periods of support will have less of an effect on models, with longer periods having more sustained impacts.*

- *The data going into the assessment would need to be considered. It would need to be established whether and how changes to loan contracts, models, schemes, segments have been captured and administered in operational systems and how these are reflected in the data used for model validation*

- *This is also likely to differ for each country in which the bank operates and be dependent on the local Governments' varying responses to COVID-19. Payment holidays may not be offered on the same basis (or at all) in all territories.*

Model segmentation

- *The bank will need to consider whether systems and data allow the above segments to be tracked separately, and the extent to which these segments will carry on being necessary going forward.*

- *Existing model segmentation may no longer be appropriate, as indicators such as Population Stability and Gini across segments may no longer hold.*

- *Where impacts are expected to be sustained, it is likely that separate segmentation will be needed for a longer period to appropriately track impacts.*

- *Most likely that enhancement segmentation would be needed for at least 12-18 months.*

- *Segmentation challenges by country of operation may also differ. Where data is richer and payment holidays are longer in term / applying across more portfolios, more allowance will need to be made.*

Staging Assessment

- *The staging assessment is likely to be significantly affected, as IFRS 9 requires that accounts that are 30 DPD to be classified into Stage 2.*

- *However, if under payment holiday terms, customers aren't required to make monthly payments in full, then consideration needs to be given to how delinquency and aging needs to be determined.*

- *Most likely these customers would not be flagged as having missed payments during the period of the payment holiday.*

- *If take up is voluntary, higher risk customers are likely to take up the scheme, which would affect the number of loans in Stage 2 (as these would likely have been flagged).*

- *If the scheme is applied to all customers automatically, likely all staging is affected, and the impact is likely be more significant (although the better customers are unlikely to have been flagged into Stage 2 in any event)*

- *Consideration would need to be given as to what happens when the moratorium period ends, as most likely high-risk customers will roll into Stage 2.*

- *Depending on the extent of economic depression, these customers may possibly roll directly into Stage 3.*

- *In which case the provisions would have been underestimated during the payment holiday period, resulting in needing a large increase when the period ends*

- *The bank therefore needs to estimate the expected transition into Stage 2 and Stage 3 to prevent this volatility.*

- *Staging definitions and the above challenges are also likely to different by country. In some territories, no payment holidays may be offered (or on different terms) and hence there may be limited impact. In these territories, more Stage 2 loans may appear due to the impact of general macroeconomic depression.*

Risk models

- *The bank would need to consider the effect on its underlying credit risk models (PD, LGD, EAD, FLI, Scorecards, Stress Testing).*

- *Application scorecards are likely to still work as intended, unless they make use of behavioural data from credit bureaus or other banks, in which case behavioural data may be affected by payment holidays. There may be a risk of customers shopping around to increase overall credit access.*

- *Behavioural scorecards / Probability of Default Models often are driven by delinquency information (DPD/ Days-past-due), and so where payment holidays affect Days-past-due, these models may under-predict expected default rates.*

- *Similarly, increases in amortising loans (as unpaid interested are added to the balance) may lead to over-prediction if the movement in balances are used in the ratings system*

- *EAD models will not project expected exposure run down as calibrated. The extent of inaccuracy will depend on the bank's approach in dealing with payment holidays.*

- *For EAD evaluation, consideration would need to be given to whether the payment holidays relate to interest. principal, both, and whether these are due after the payment holiday ends, over the remaining term, whether the term is extended, or whether a bullet payment at the end is required.*

- *LGD models will likely need to have extended recovery periods as it takes longer to recover outstanding amounts. The amount recovered may also be affected, especially depending on the duration of the economic difficulty that precipitated the programme.*

- *The segmentation of the above models is likely to require amendment as discussed above.*

- *Model risk challenges by country of operation may also differ. Where data is richer and payment holidays are longer in term / applying across more portfolios, more allowance will need to be made.*

Other considerations

- *Model monitoring reports and metrics may need to be reassessed compared to prior reports*

- *These reports often segment by DPD and delinquency information which may be less representative during this period*

- *Additional segments requiring monitoring would also need to be identified*

- *Key metrics such as Gini, PSI, p-values and other statistics may need to be reassessed. There may be breaches when compared to usual thresholds, however these may be acceptable given the data limitations.*

- *It may be recommended to suspend formal validation/recalibration activities during this time as the current experience is unlikely to be sustained or representative of future experience*

- *Indicator variables may be used to account for these one-off impacts, for example to indicate the period affected, or segments affected*

- *Finally, overlays may also be more readily applied during this time to account for model deficiencies.*

- *The governance around these adjustments needs to be clear to ensure a transparent process, that allowed all subject matter experts to contribute to the decision, with full information, was followed.*

To incorporate forward looking information into the provisions, UAB has developed the following 2 macroeconomic linkage models for its South African Mortgage and Credit Card portfolios.

$$PD_{Mortgages} = 0.02 - 0.07.(\Delta GDP) - 0.2.(\Delta PPI) + \varepsilon$$

$$PD_{Credit\ Cards} = 0.06 - 0.4.(\Delta GDP) + 0.15.(lagUE) + \varepsilon$$

The following variables have been used:

$PD_{Mortgages}$ is the expected probability of default of the mortgage portfolio at a forward looking time period.

$PD_{Credit\ Cards}$ is the expected probability of default of the credit card portfolio at a forward looking time period.

ΔGDP is the corresponding expected change in gross domestic product growth. You may assume that

change is defined as the difference in the quarter-on-quarter macroeconomic variable.

ΔPPI is the corresponding expected change in a property price index inflation. You may assume that change is defined as the difference in the quarter-on-quarter macroeconomic variable.

$lagUE$ is a lagged level of unemployment. You may assume it is a one quarter lag macroeconomic variable.

ε is a random error term.

The table below summarises actual historic Macro Economic Variable data and three quarters or forecasts:

	Long Run	Q1 – actual	Q2 – forecast	Q3 – forecast	Q4 – forecast
GDP growth	5%	3%	-2%	1%	1%
PPI inflation	3%	1%	1%	0.5%	0.2%
Unemployment	10%	15%	15%	17%	20%

iii.   Discuss the appropriateness of the existing forward-looking models being used, including potential alternative approaches of incorporating economic forecasts in making allowance for forward-looking requirements in UAB's IFRS 9 provisions.

[12]

The table below summarises the variables used in the forecasting model and the corresponding PD model outputs.

	Long Run	*Q1 – actual*	*Q2 – forecast*	*Q3 – forecast*	*Q4 – forecast*
ΔGDP	-	-	*-5.00%*	*3.00%*	*0.00%*
ΔPPI	-	-	*0.00%*	*-0.50%*	*-0.30%*
Lag(Unemployment)	-	-	*15%*	*15%*	*17%*
PD (Mortgages)	*2.0%*	-	*2.35%*	*1.89%*	*2.06%*
PD (Credit Cards)	*7.5%*	-	*10.25%*	*7. 05%*	*8.55%*

Model specification:

- *Mortgage PD model*
  - *The mortgage PD model is driven by a change in GDP and a change in Property Price Index.*

  - *These two variables are intuitive to include for a Mortgage portfolio.*

  - *A higher GDP growth leads to lower PD, as expected.*

  - *A higher PPI leads to lower PD, as expected.*

  - *Overall, the mortgage PD model is more sensitive to PPI, which may be reasonable for a mortgage portfolio where the loan is directly secured by property.*

  - *The overall mortgage PD is around 2%, which appears reasonable.*

- *Credit Card PD model*
  - *The Credit Card PD model is driven by a change in GDP and a change in Unemployment.*

  - *These two variables are intuitive to include for a Credit Card portfolio.*

  - *A higher GDP growth leads to lower PD, as expected.*

  - *A higher unemployment leads to higher PD, as expected.*

  - *The effect of unemployment is lagged, which is reasonable as there is time lag between someone losing their job and missing payments (relying on savings)*

  - *The effect of lag in Unemployment appears to higher than GDP due to using absolute value of this variable instead of the change in variable.*

  - *The overall Credit Card PD is around 7.5%, which appears reasonable relative to the Mortgage portfolio.*

Interpretation of results

- *Mortgage model*
  - *Q1 to Q2 sees a big decrease in GDP, with no change in PPI. As a result, the mortgage PD increases to 2.35% from the long run PD level of 2%.*

  - *Q2 to Q3 sees a big relative increase in GDP (although absolute GDP goes from -2% to 1%) with a small decrease in PPI.*

  - *The model interprets this change in GDP as positive economic recovery, which results in a mortgage PD of 1.89% which is better than the long run of 2%, despite the absolute level of GDP and PPI being worse than long run conditions.*

  - *Q3 to Q4 sees no change in relative GDP growth, although the absolute GDP growth stays depressed at 1%. The overall PD increased to 2.06% higher than the long run level of 2%.*

  - *The results show that the model is highly sensitive to change in GDP and incorrectly interprets the GDP moving from -2% to 1% as having a highly positive effect on PD.*

  - *The results indicate that current macroeconomic conditions are different to conditions under which the model was calibrated, resulting in inappropriate results.*

  - *The model should not be used as is as it may underestimate provisions.*

- *Credit Card model*
  - *Q1 to Q2 sees a big decrease in GDP growth, with no change in the lag of Unemployment. As a result, the CC PD increases to 10.25% from the long run level of 7.5%.*

  - *Q2 to Q3 sees a big relative increase in GDP growth with no change in lag UE.*

  - *Like the Mortgage model, the Credit Card model interprets this as positive recovery and results in CC PD of 7.05% which is better than the previous quarter, and the long run PD of 7.5% (despite the absolute level of GDP growth being worse than long run).*

  - *Q3 to Q4 sees no change in relative GDP growth, although lag UE increase to 17%. The overall PD increased to a level of 8.55%.*

  - *The results show that the model is highly sensitive to change in GDP growth and incorrectly interprets the GDP moving from -2% to 1% as having a highly positive effect on PD.*

  - *The results indicate that current macroeconomic conditions are different to conditions under which the model was calibrated, resulting in inappropriate results.*

  - *The model should not be used as is as it may underestimate provisions.*

Alternative options:

- *The probability weights for the different scenarios would need to be considered. As forecasts become closer to downside scenarios, the weight applied to further downside may need to be reduced to not be overly conservative.*

- *Given limitations in the more sophisticated models, more simplified approaches (such as single factor models) may be used reducing reliance on multiple factors. For example, had the Mortgage model been based largely on PPI, the results would be more intuitive.*

- *Macroeconomic relationships may be built based on the level of variable as opposed to the change in variable. This may capture non-normal operating conditions better and ensure that the model interprets current depressed economic conditions appropriately.*

- *Stress testing models may be used to supplement or override existing FL models. Stress testing models are often built under more extreme conditions and so will likely produce more appropriate outputs.*

- *Expert judgment overlays may be used to replace model outputs in the near term. It will be important to ensure that these are based on data where possible.*

- *A combination of the above.*

iv.   Describe how UAB Bank can use a management overlay framework for dealing with risk not adequately captured in the models.

[5]

- *The first way to identify whether risk is not being captured in the models is to perform detailed model monitoring. In this way the Bank can identify whether changes in provisions are because of model parameters changing over time, or because of material change in external factors.*

- *Where changes are because of trends in underlying risk drivers, the bank can more frequently recalibrate its model parameters. In doing so, it can minimise any mismatch between what the model is estimating, and what actual loss experience shows.*

- *Where the models are not adequately capturing risks, the Bank can develop an overlay framework to adjust ECL outputs.*

- *The bank may find that some factors cannot be captured in a statistical manner.*

- *For example, some locations in which it has property loans may be exhibiting higher loss rates than other areas. However, it may be that there is no reliable property price index available for relevant sub-segments.*

- *In these instances, the Bank may decide to use a judgmental expert judgment approach to adjust ECL's up or down to account for this risk.*

- *As these adjustments are not model driven, the Bank will need a well-documented process that explains how this adjustment is quantified, reviewed, and challenged.*

- *It should also be backed by quantitative analysis where possible. If for example, PDs are increasing over the past 6 months but the model averages over a 24-month period, the Bank can consider making an adjustment to reflect this deterioration while the model calibration takes time to catch up.*

- *These adjustments would also need to go through rigorous debate and challenge at technical and audit committees*

- *These adjustments are not expected to be permanent. This adjustment can be removed over time as the model catches up, or as the experience reverts to "normal"*

- *The Bank will need to frequently re-assess the need for overlays, and document how they plan to release them over time.*

- *This will be even more important during COVID times where data and economic conditions are changing at a more rapid pace.*

[Total 36]

[Grand Total 100]