

ILA LRM Model Solutions

Spring 2019

1. Learning Objectives:

1. The candidate will demonstrate an understanding of the principles of Risk Management.
3. The candidate will demonstrate an understanding of important risk measurement techniques along with their uses and limitations, and be able to perform risk measurement calculations.

Learning Outcomes:

- (1b) Evaluate the role of risk management within an insurance company
- (1d) Describe how risk management techniques may be used to manage capital deployed by insurers and how they impact strategic decision making.
- (3a) Analyze and evaluate risk measures & estimators (e.g., Value-At-Risk, Conditional Tail Expectations, etc.)

Sources:

Risk Appetite: Linkage with Strategic Planning

LRM-100-14: The Theory of Risk Capital in Financial Firms – Chew

LRM-127-15: Measures of Financial Risk, Dowd, Ch. 2, pp. 19 – 32

LRM-111-14: Value-at-Risk: Evolution, Deficiencies, and Alternatives

Commentary on Question:

Candidates did better on part a) and b) but poorly on part c). In order to receive full credit, candidates must give conclusions or recommendations where asked.

Solution:

- (a)
 - (i) Define risk appetite.
 - (ii) Describe the three increasingly detailed levels in a risk appetite framework.

1. Continued

Commentary on Question:

Most candidates did well on this part. For part ii, some candidates failed to describe the “Increasing detailed levels”.

- (i) Any of following definitions would receive full credit:
- The total risk exposure an organization will undertake to achieve its objectives.
 - The amount of risk, on a broad level, an organization is willing to take on in pursuit of value. Or, the total impact of risk an organization is prepared to accept in the pursuit of its strategic objectives.
 - Often taken to be the maximum amount of risk a company is willing to accept in pursuit of its mission/objectives/plans.
 - Risk appetite is a high-level view of the risks the insurer (organization is willing to assume in pursuit of value.
- (ii) Risk appetite framework normally includes three detailed levels:
1. **Enterprise risk tolerance:** the aggregate amount of risk the company is willing to take, expressed in terms of capital adequacy, earnings volatility, credit rating target. It represents the company's long-term target and shall be revised only if there are fundamental changes to the company's financial profile, market situation and strategic objective.
 2. **Risk appetite for each risk category:** Enterprise risk tolerance needs to be allocated to risk appetite for specific risk categories and business activities. By doing this, the company's resources, such as capital, can be allocated to the areas in which the company feels comfortable or has competitive advantage. When determining or updating risk appetite for difference risk categories, the platform, analytic tools and conclusions also are instrumental in identifying risk-taking activities that have relatively high risk-adjusted return.
 3. **Risk limit:** Risk limits are the most granular level used for business operation. It translates enterprise risk tolerance and risk appetite for each risk category into risk-monitoring measures. The consistency between risk limit and enterprise risk tolerance helps the company realize its risk objective and maximize risk-adjusted return.
- (b) Determine if ABC is currently fulfilling its risk appetite statement. Show all work.

Commentary on Question:

Most candidates were able to calculate RAROC correctly though some forgot to count diversification while others confused PV(Required capital) with Required capital. Candidates struggled less with calculation of post-stress capital. The question asks to assess on a company level but most candidates calculated on a product level. However, no credit was deducted for additional work as long as the correct conclusion was derived on a company level.

1. Continued

RAROC:

Formula:

$$RAROC = \frac{PV(\text{Underwriting Profit}) + PV(\text{Investment Income on Capital})}{PV(\text{Required Capital})} (1 - t)$$

$$PV(\text{Underwriting Profit}) = 2 + 5 = 7$$

$$PV(\text{Investment Income on Capital}) = 10 + 2 = 12$$

$$PV(\text{Required Capital}) = (80 + 20) * (1 - 10\%) = 90$$

$$T = 21\%$$

$$RAROC = (7 + 12) / 90 * (1 - 21\%) = 16.7\% > \text{Target RAROC (15\%)}$$

Post-Stress Capital:

Formula: Post-Stress Capital = Required Capital under stress scenario *(1 - diversification benefit %)

$$\text{Required Capital} = (70 + 20) * (1 - 10\%) = 81$$

$$\text{Available Capital} = 100$$

$$81 / 100 = 81\% < 85\%$$

Yes, the company does fulfill its risk appetite statement:

1. the RAROC is 17%, which is greater than the requirement of 15%
2. the capital under 1-in-200-year stress event is \$81m, or 81% of its current available capital; this is less than 85%.

- (c) Recommend actions the company can take to optimize capital allocation to maintain a 120% internal target capital ratio.

Commentary on Question:

Candidates did poorly on this part as most of them made recommendations based on RAROC instead of Capital Ratio. Some candidates missed the diversification credit in the required capital calculation. Some candidates misread the question as how to improve capital ratio, which is opposite to this case.

Capital Ratio = Available Capital/Required Capital

Current available capital = 100

Current total required capital = (60 + 15) * (1 - 10%) = 67.5

Current capital ratio = 148% > 120%

Current capital ratio is higher than target capital ratio

Or

Target Available Capital (using 120% target ratio) = 67.5 * 120% = 81 < 100

Total available capital is greater than total target available capital.

1. Continued

The company can reduce available capital to optimize capital allocation while maintaining the target capital ratio by doing one of following (any one from the list below will receive full credit):

- Dividend payment to shareholders or share buy backs
- Take up more business opportunities
- Increase size and/or risk of existing business

(d) ABC is proposing the following be added to the company's risk appetite statement:

- “Asset portfolio risk limits should be set using a Value-at-Risk (VaR) metric comparable to a similar-sized insurer's VaR.”*
- “Portfolio managers should receive an annual bonus if the company's total VaR is below the limit.”*

Critique the proposal.

Commentary on Question:

Most candidates did relatively well on this part.

- VaR has some shortcomings and ABC may want to consider additional measures as well:
 1. VaR doesn't measure the risk in the tail: if tail event occurs, it gives no indication of how much you could lose as risk exposure would be significantly different with the same VaR
 2. ABC should not use the same VaR measure with a similar-size company:
 - i. Different companies may use very different VaR calculations with different time horizon, observation period and/or simulation method.
 - ii. Different companies could have different parameter risk in their models
 - iii. Different companies could have different risk appetite and risk management program

CTE could be a better alternative to measure asset portfolio risk.

- (ii) This is not a good plan for risk management as it can introduce agency problems. Since VaR doesn't measure the tail risk, managers may have incentive to take excessive risks with big payoffs which could return the same VaR number. Managers may also make risk portfolio decisions that place the company at risk for large losses without alerting stakeholders and senior management.

CTE could be a better measure for portfolio management.

2. Learning Objectives:

4. The candidate will demonstrate an understanding of the principles of modeling, cash flow testing and asset-liability matching, and perform related calculations.

Learning Outcomes:

- (4b) Define and calculate duration, convexity and key rate durations including the rationale for matching as a means to manage risk

Sources:

LRM-120-14: Chapter 14 of Life Insurance Products and Finance, Atkinson/Dallas
Section 14.4 only on ALM Matching

Commentary on Question:

Commentary listed underneath question component.

Solution:

- (a)
 - (i) Define immunization of an investment portfolio.
 - (ii) Explain the benefits of immunizing an investment portfolio.
 - (iii) Contrast exact matching versus duration matching.

Commentary on Question:

Most candidates provided explanation for immunization or gave examples of it, i.e. duration matching, instead of stating the definition. Only partial points were given for such cases. For part iii, simply listing out the definition of duration matching and exact match did not receive points. Candidates were expected to explicitly compare the two approaches and comment on the differences. Among the key differences listed below, the first two were commonly called out by candidates while much less so for the other two.

Immunization matches the assets and liabilities of a company

Immunizing an investment portfolio protects the company from significant shifts in surplus volatility and hedges the financial gain/loss due to changes in interest rates.

To compare exact matching versus duration matching:

- Exact matching matches future cash flow exactly while duration matching can have cashflows which are significantly mismatched
- Exact matching is impractical, i.e. you cannot match CFs beyond 30 years, it would be nearly impossible to structure etc, while duration matching is much easier in practice

2. Continued

- Exact matching implies that both duration and convexity are well-matched while duration matching works only for small changes in interest rates
- Exact matching requires rebalancing if cash flows don't emerge as expected, i.e. in cases of asset defaults, while duration matching requires constant rebalancing/monitoring

(b)

- (i) Derive a duration matched investment portfolio.
- (ii) Describe the limitations of only having the above two fixed income assets available for purchase to back the existing product line.
- (iii) Recommend changes to the investment strategy under the following interest rate environments:
 - Interest rates are expected to rise
 - Interest rates are expected to fall

Commentary on Question:

Most candidates did well on i) where full credit was awarded by using either Macaulay Duration or Modified Duration in calculating the weights of the matched portfolio, as the two approaches result in same answer. Common mistakes for part i) included 1) not applying consistent duration calculations between asset and liability 2) not using present value of future cashflows when calculating the time zero weight of the asset portfolios.

For part ii) full credit was given when two correct limitations were identified in candidates' answer. While many candidates were able to point out the potential of significant cashflow mismatch being one limitation, only a few candidates correctly identified other potential limitations of having only these two assets to back liabilities.

(i)

$$\text{MacDuration (i)} = \frac{\sum t \cdot v^t \cdot \text{Cashflow}(t)}{\sum v^t \cdot \text{Cashflow}(t)}$$

$$\text{ModDuration (i)} = \text{MacDuration} / (1+i)$$

Where i is the interest rate, and $v = 1/(1+i)$

$$\begin{aligned} & \text{MacDuration of Liability} \\ &= [1 \cdot 100 \cdot 1/(1+4\%) + 2 \cdot 150 \cdot 1/(1+4\%)^2 + 3 \cdot 200 \cdot 1/(1+4\%)^3 + \\ & 4 \cdot 500 \cdot 1/(1+4\%)^4] / [100 \cdot 1/(1+4\%) + 150 \cdot 1/(1+4\%)^2 + 200 \cdot 1/(1+4\%)^3 + \\ & 500 \cdot 1/(1+4\%)^4] \\ &= 2616.5 / 840.0 \\ &= 3.115 \end{aligned}$$

2. Continued

$$\begin{aligned} & \text{ModDuration of Liability} \\ &= \text{MacDuration of Liability} / (1+4\%) \\ &= 2.995 \end{aligned}$$

$$\begin{aligned} & \text{MacDuration 4 year bond} \\ &= 4 * v^4 * \text{Cashflow}(4) / v^4 * \text{Cashflow}(4) \\ &= 4 \end{aligned}$$

$$\begin{aligned} & \text{ModDuration 4 year bond} \\ &= \text{MacDuration 4 year bond} / (1+4\%) \\ &= 3.846 \end{aligned}$$

$$\begin{aligned} & \text{MacDuration 1 year bond} \\ &= 1 * v^1 * \text{Cashflow}(1) / v^1 * \text{Cashflow}(1) \\ &= 1 \end{aligned}$$

$$\begin{aligned} & \text{ModDuration 1 year bond} \\ &= 1 * v^1 * \text{Cashflow}(1) / v^1 * \text{Cashflow}(1) \\ &= 0.962 \end{aligned}$$

To duration match the portfolio, we set:
Duration of Assets = Duration of Liabilities

$$\begin{aligned} & X * \text{Duration of 1 year bond} + (1-X) * \text{Duration of 4 year bond} \\ &= \text{Duration of Liabilities} \end{aligned}$$

Either MacDuration or ModDuration can be used here, but needs to be applied consistently on both sides of the equation. Using ModDuration here as example:

$$\begin{aligned} & X * 0.962 + (1-X) * 3.846 = 2.995 \\ \Leftrightarrow & X = 29.51\% \end{aligned}$$

Thus, to duration match the portfolio, it needs 29.51% of the portfolio being 1 year bond, and the other 70.49% of portfolio being 4 year bond.

2. Continued

(ii)

Limitations of only having these two fixed income assets available for purchase to back the existing product line include but are not limited to the following items:

- With only 1-year and 4-year assets available, we can match duration but have some significant issues matching the cash flows
- UL with adjustable crediting rates has interest-sensitive liability cash flows, which means liability cash flow could change based on interest rate movements, asset portfolio would need to be rebalanced in these cases
- If one of the assets defaults, the portfolio manager would need to rebalance the portfolio, but given there are only two asset choices, a default in any of the assets will render an asset portfolio that is unable to duration or convexity match the existing liability portfolio
- With only these two assets in the fixed income portfolio, we have less flexibility to both duration and convexity match the liability portfolio, which will potentially increase the block's interest rate risk

(iii)

When interest rates are expected to rise, it is recommended the insurer should hold shorter assets compared to liability duration. An impending rising interest rate environment implies the insurer is subject to disintermediation risk. This is the risk that policyholder will withdraw their money and put it in more advantageous financial instruments, which will decrease the expected liability cash flow duration. Having shorter asset duration will give the insurer some earlier-than-needed asset cash flows to help offset unexpected liability cash flows that might be caused by this increase in interest rates.

When interest rates are expected to fall, it is recommended the insurer should duration match their assets and liabilities. An impending decreasing interest rate environment implies the insurer is subject to reinvestment risk. This is the risk that shorter assets will mature and won't be able to be reinvested at rates as high as current interest rates. Having assets and liabilities duration matched will help reduce losses generated from investing in assets whose yields are not as high as the assets that matured.

3. Learning Objectives:

2. The candidate will demonstrate an understanding of the various sources of risks faced by an insurer.
3. The candidate will demonstrate an understanding of important risk measurement techniques along with their uses and limitations, and be able to perform risk measurement calculations.

Learning Outcomes:

- (2b) Identify, categorize and evaluate potential sources of risk in investments including but not limited to credit risk, liquidity, equity-based exposure and asset-liability matching.
- (2c) Describe and evaluate the other risks an insurance company faces including operational, marketplace and expense risks.
- (3a) Analyze and evaluate risk measures & estimators (e.g., Value-At-Risk, Conditional Tail Expectations, etc.)

Sources:

LRM - 126 - 15: Liquidity Risk, Saunders & Cornett, Ch. 17, pp. 493 - 514

Commentary on Question:

In general the question was well answered. There were numerous candidates who did well on all parts of the questions. For candidates who did not do well, often it was the result of writing lots of extraneous information that was factual to the case study, but not pertinent to answering what the question asked. One theme was the frequent mention of stress tests as a random recommendation written down when in doubt. Another theme was to list out all possible risks of the product, even though the question asked specifically about one type of risk (i.e. liquidity).

Solution:

- (a) Explain how a depository institution can manage its liability-side liquidity risk.

Commentary on Question:

Most candidates did well on this question. The majority of candidates were able to name purchased liquidity management and stored liquidity management, as well as explain what each concept entails. A high proportion of these candidates were also able to speak to the difference between the two approaches in terms of balance sheet impact. A minority of candidates made no mention of these concepts, and gave generic, vague answers to the effect of "use risk metrics".

A depository institution (DI) can manage net deposit drains in two major ways: purchased liquidity management and stored liquidity management.

3. Continued

Purchased liquidity refers to turning to the markets for funds, such as short term loans through interbank markets or issuing bonds. This may be expensive, depending on current rates, and is also subject to market availability. In terms of balance sheet impact, purchased liquidity allows the DI to maintain the same balance sheet size by adjusting only the liability side of the balance sheet.

Stored liquidity refers to setting aside extra assets or cash reserves, so that they can be sold and utilized in the event of a deposit drain. Doing so contracts the DI's balance sheet, as both asset side and liability side shrink. Further, these assets and cash reserves must be liquid, and therefore earns little to no investment return.

- (b) For each of the four products offered by Simple Life:
 - (i) Assess the liquidity risk.
 - (ii) Propose risk mitigation strategies.

Commentary on Question:

Some candidates over emphasized product features such as minimum guaranteed crediting rate, or VA guarantees while ignoring anything related to actual fund withdrawals, thereby missing the role of surrender charge structure in the product. In recommending mitigation strategies, some candidates make no direct connection to surrenders and only suggested monitoring activities such as calculating metrics or performing stress tests, which do not actually mitigate policyholder behavior. Some candidates cited case study material that were irrelevant for the consideration of liquidity risk. For example, Simple Life's Term product being underpriced does not create liquidity risk exposure since Term has no cash value. There was a general tendency of some candidates to indiscriminately write down a lot of things that are true statements, but not pertinent to the question at hand.

Liquidity risk arises when policyholders surrender their policies for cash value.

Term: Since the product has no cash value, there is no liquidity risk. It can be argued that should a catastrophic mortality event such as a pandemic take place, a large amount of death claims would arise, thereby potentially causing a liquidity event. This risk can be mitigated through reinsurance, or selling policies across many unconnected geographic locations for catastrophic risk diversification.

SPIA: Since the product has no cash value, there is no liquidity risk, and no mitigation strategy is needed. (Unlike Term, where adverse mortality can come through a single catastrophe, adverse longevity emerges gradually over time, and therefore would not generate a liquidity event)

3. Continued

UL: This product allows partial surrenders up to 25% of cash value once a year, as well as full surrenders subject to a surrender charge. Although the surrender charge mitigates liquidity risk, when the surrender charge period ends, there is a risk of a shock lapse, creating a potential for a liquidity event. To mitigate this, Simple Life can increase the surrender charges, extend the surrender charge period, reduce the percentage of partial surrenders allowed.

VA: Similar to UL. Although partial surrenders are not allowed, policyholders can surrender the entire policy for cash value. The surrender charge decreases the liquidity risk in the first ten years, but at the end of the surrender charge period, there is a risk of a shock lapse, creating a potential for a liquidity event. To mitigate this, Simple Life can increase surrender charges, extend the surrender charge period, and use proportional partial withdrawal instead of dollar-for-dollar, to discourage a scenario where a policyholder drains the account value but the ratio of guaranteed benefit as a percentage of account value increases.

- (c)
- (i) State the concept that describes Investment capital being used to cover the insurance loss.
 - (ii) Recommend an approach to ensure capital flexibility under future stressed scenarios.

Commentary on Question:

Most candidates answered this question well. Almost all candidates recognized this as fungibility, with many going on to describe its relation to transferability. Many candidates listed not just one recommendation but several. A minority of candidates again fell back to the habit of recommending stress testing, which seems to be a popular default suggestion for any risk question when in doubt.

The concept is fungibility. There are several approaches to ensure capital flexibility under future stressed scenarios:

- Intra-group loans
- Reinsurance (internally between legal entities, or external)
- Monetise future profits/dividend
- Contingent loans (from a bank, etc)
- Simplify legal structure through a branching structure

Each approach has its pros and cons. One example would be to recommend using intra-group loans, as it limits costs, is not subject to market availability, and is unlikely to impact strategic objectives. Further, unlike the other options, intra-group loan involves no external parties, therefore reduces potential implementation difficulties, execution risk and counterparty risk.

3. Continued

- (d) The risk modeling team has developed a stochastic model for mortality risk with the following design characteristics:
- (i) The model only includes term and UL.
 - (ii) Calibration was based on the last 5 years of combined term and UL mortality experience.
 - (iii) Variable annuities have been excluded as the GMDB is deep out of the money.
 - (iv) Single premium immediate annuities have been excluded as a conservative approach.

Critique the model design. Recommend any changes.

Commentary on Question:

This question was answered well for the most part. Many candidates were able to point out the importance of separately calibrating mortality assumptions of Term vs UL due to the differences in policyholder demographics and product underwriting. The 5 year horizon of the mortality experience as well as potential data credibility were also identified. A minority of candidates did not have a good understanding of how to set mortality assumption, and suggested that the mortality experience of all four products should be combined together. While most candidates pointed out that SPIA as a product is exposed to longevity risk, not all candidates then connected it to a need for Simple Life to quantify its exposure to worsening vs improving mortality to determine what the company's risk driver was and determine model scope accordingly. Few candidates recognized the evolving nature of risk and the need to monitor new risks introduced from Simple Life's planned product changes.

- (i) Including only Term and UL is inappropriate, as it does not provide a holistic view of the company's risk exposure, nor does it capture risk interaction and diversification. Although the company is confident that currently its risk driver is adverse mortality and not longevity, it would provide useful insights to quantify the exposure size of mortality and longevity, and monitor any shifts on a go-forward basis as the company's product mix changes over time.

3. Continued

- (ii) It is not appropriate to group the mortality calibration of Term and UL. These are very different products, sold to different demographics, with different underwriting. Further, 5 years of data is limited in usefulness, as Simple Life's target market has evolved over time, the time period itself is too short, and the resulting data will be heavily weighted towards Term experience due to the company's sales mix during that period. If Simple Life's data has limited credibility, it can consider incorporating other relevant external industry data that has applicably similar characteristics as its products.
- (iii) Although GMDB is currently out of the money, as markets move it may quickly become in the money. It is therefore not a good reason to exclude VA from the model on this basis. Furthermore, Simple Life has plans to change product features, available riders and guarantee features of its VA offerings. As these product changes take place and if sales take off, Simple Life will likely need to incorporate VA into the model to capture all risks.
- (iv) As Simple Life's product appears to be on a trend of higher mortality improvement than expected, it is important to quantify the longevity risk exposure the company has. Although recent sales have been slow, Simple Life has ambitions to grow beyond being known as a Term seller, and may try to significantly expand its SPIA business. As SPIA sales volume grows and longevity risk exposure becomes more material to the overall business, Simple Life will need to include SPIA in its model assessment to determine whether the overall risk driver of the company is longevity or adverse mortality.

4. Learning Objectives:

1. The candidate will demonstrate an understanding of the principles of Risk Management.
2. The candidate will demonstrate an understanding of the various sources of risks faced by an insurer.

Learning Outcomes:

- (1d) Describe how risk management techniques may be used to manage capital deployed by insurers and how they impact strategic decision making.
- (2c) Describe and evaluate the other risks an insurance company faces including operational, marketplace and expense risks.

Sources:

A New Approach for Managing Operational Risk - SOA Research 2008

2nd Revision of Educational Note: Dynamic Capital Adequacy Test, November 2017
(pages 4 – 36)

Commentary on Question:

Commentary listed underneath question component.

Solution:

- (a) The Risk Management Department for LAN Life documented the following approach for managing the company's operational risk:
 - (i) All LAN Life managers are asked to identify the major risks in their department;
 - (ii) A Monte Carlo simulation is used to calculate the cumulative loss potential across all risk classes;
 - (iii) Both frequency and severity are aggregated enabling the overall results to be aggregated;
 - (iv) The probability weighted loss is measured for each specific incident;
 - (v) Loss prevention is accomplished through day-to-day management of current threats arising from imminent operational failures.

Critique the approach if the objective is to manage operational risk under a Modern Operational Risk Management approach.

4. Continued

Commentary on Question:

The question assessed knowledge of Modern Operational Risk Management. Most candidates were able to identify which items were under Traditional Operational Risk Management, however did not provide the approach under Modern Operational Risk Management to get full marks.

- (i) Applicable under Traditional Operational Risk Management (ORM) for Modern ORM the process should:
 - Define a finite mutually exclusive risk universe instead of all managers
 - (ii) Consistent with Modern ORM
 - (iii) Partially applicable to Modern ORM, however only frequency is aggregated
 - (iv) Applicable under Traditional Operational Risk Management (ORM) for Modern ORM the risk measured should be:
 - Cumulative loss for one or more risk, both the expected and unexpected loss
 - (v) Applicable under Traditional Operational Risk Management (ORM) for Modern ORM:
 - Specifically optimization of risk-reward and risk-transfer in the context of cost-benefit analysis
- (b) Assess whether the loss prevention system should be implemented. Show all work.

Commentary on Question:

This part of the question was well answered. Most candidates derived the correct formulas, performed the calculations correctly and provided an appropriate recommendation.

$$\text{Cost of Risk} = \text{Expected Loss} + \text{Cost Capital} \times \text{Unexpected Loss}$$

$$\begin{aligned} &\underline{\text{Cost of Risk without prevention system}} \\ &= 15 + 0.12 \times 35 = 19.2 \end{aligned}$$

$$\begin{aligned} &\underline{\text{Cost of Risk with prevention system}} \\ &= 6 + 0.12 \times 14 = 7.68 \end{aligned}$$

Reduction of Cost of Risk is $19.2 - 7.68 = 11.52\text{M}$. This is greater than the cost of 10M of the loss prevention system therefore the system should be implemented.

4. Continued

- (c) LAN implements a loss prevention system maintained by a third-party vendor which is expected to reduce losses by 30%. In the Dynamic Capital Adequacy Test (DCAT), LAN's Chief Actuary recommends including a scenario that captures the breakdown of this system.
- (i) Explain if this is a plausible adverse scenario.
 - (ii) Describe two potential ripple effects and management actions for each.

Commentary on Question:

This question assessed candidates on applying DCAT concept, with a focus on ripple effects and management actions. Generally candidates performed well in identifying ripple effects but had difficulties with a corresponding management action. Most candidates provide non-specific risk mitigation actions.

- (i) The scenario is plausible since the system is maintained by a third-party vendor; the probability of the system failure is non-zero.

The scenario is adverse since the system is expected to reduce loss by 30%. A failure would trigger significant losses and be a threat to the company's financial situation.

- (ii) Ripple effect: Breakdown in loss prevention creates additional losses resulting in liquidity issues and increased asset liability mismatch since asset are sold to pay claims.

Management Action: Dividend payment, capital transfer to parent and investment in projects are reduced, increasing available cash to pay claims reducing the liquidity issues.

Ripple effect: Breakdown in loss prevention damage the company's reputation, leading to lower new business sales and poor expense coverage.

Management Action: Control over non-variable expenses levels and reviewing bonus paid to agents and brokers to increase sale and improve expense coverage.