MILLIMAN REPORT

Streamlining scenario testing

A framework for streamlining stress and scenario testing

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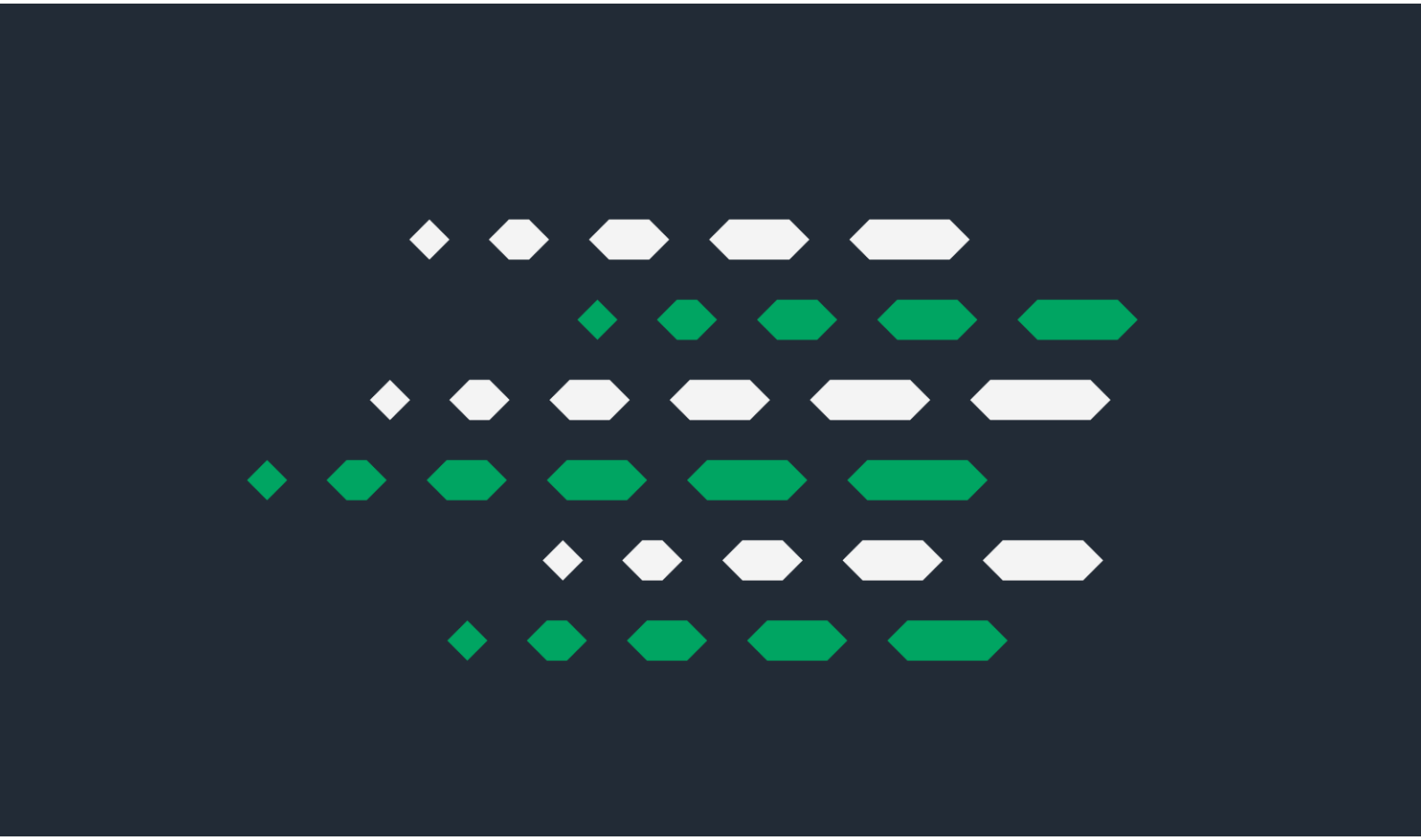

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1 Introduction

(Re)insurance companies conduct stress and scenario testing (SST) for a whole variety of purposes, both for ad-hoc exercises and for regular (usually annual) risk management or reporting processes. The demands placed on companies, however, have increased significantly in recent years, as new requirements have emerged and evolved, sometimes driven by new regulation and sometimes by the maturing of existing risk management frameworks. Many companies now require SST to be performed for numerous different purposes, such as the Own Risk and Solvency Assessment (ORSA), pre-emptive recovery planning, liquidity management, business planning and operational resilience, and to examine the potential impacts of sustainability.

In our experience, the process of defining appropriate sets of stresses and scenarios for different purposes is often quite siloed in nature, i.e., each exercise is considered in isolation rather than in a coordinated way, leading to inefficiencies and to inconsistencies between different sets of stresses and scenarios that are chosen for different purposes.

To help address these issues, this paper proposes the creation of a robust scenario selection framework that helps to streamline the process, by consolidating all scenario requirements within a single structure, supported by a central log of scenario descriptions and calibrations. The framework aims to enhance consistency and improve controls, thereby enabling (re)insurers to meet regulatory and business needs more efficiently, effectively and appropriately.

In summary, the framework helps meet the following objectives:

1. **Efficiency**: With careful planning, it is possible to re-use individual stresses and/or scenarios for multiple purposes, as opposed to redefining the full set of stresses and scenarios each time. Having a readily available overview of all stresses and scenarios that have been used across all SST exercises can significantly reduce the calculation effort required to perform a given SST exercise. The framework aims to facilitate (re)insurers re-using scenario storylines, assumptions, parameter calibrations and results where feasible. We want to emphasise that in order to support the (re)insurer's resilience, a wide range of scenarios should still be tested over time and from different angles. Although the framework promotes the re-use of existing stress and scenario tests, such recycling of stresses/scenarios and the results of previous calculations should only be used where it is appropriate to do so.
2. **Completeness**: The framework requires mapping the risks included in a (re)insurer's risk universe to the stresses and scenarios that are used as part of the various SST exercises which are conducted throughout the year. By doing so, valuable insights are generated into which risks are properly captured and how. This completeness check also works the other way around, in order to ensure that the risk register keeps abreast of changes in risk profile. If stresses and scenarios are described as part of various SST exercises, their descriptions can be cross-checked against the risk register to ensure that there are no material gaps.
3. **Consistency**: The framework aims to achieve consistency between the (re)insurer's risk profile and how these are represented in SST exercises. Maintaining an inventory of the results of stress and scenario tests which have already been run allows the (re)insurer to decide whether or not it is necessary to recalibrate and/or recalculate a stress/scenario when using it across multiple SST exercises. In the event of a change in risk profile it is likely that a stress/scenario should be recalculated. However, if the risk profile has not materially changed, it may be possible to avoid the need to recalculate, instead continuing to use the previous results and associated insights gained from previous calculations.
4. **Integration**: Making the scenario inventory a key component of the risk management framework leads to further integration of SST into the risk management system. This holds for both the stresses/scenarios themselves and a further integration/cooperation between the various departments that work on these scenarios and provide the required inputs (e.g., financial/liquidity/operational and other elements).
5. **Transparency**: Instead of having standalone processes in place for the various purposes that rely on SST, following a standardised framework for the selection and updating of scenarios across these purposes provides a degree of transparency on the processes followed.

Our main objective is to describe the proposed framework and provide examples of how it can be applied in practice. In Section 2, we start by setting the scene by discussing typical SST exercises which must be regularly performed and providing a breakdown of the most important elements and considerations when conducting SST. Using these, a scenario testing framework is proposed in Section 3 that can be used to achieve the objectives outlined previously. Section 4 outlines a step-by-step guide on how to apply the framework, which is further demonstrated in Section 5 by means of various use cases.

The examples and use cases of the scenario testing framework that are included throughout this paper are based on an example inventory. The example can be received upon request by contacting the authors of the paper. Their contact details are included at the end of this paper.

2 Key components

2.1 SETTING THE SCENE

In a typical risk management cycle or reporting year, SST is a crucial process that supports various risk reports and compliance with regulatory requirements. Solvency II narrative reporting, the ORSA, business planning, capital management and financial reporting all require SST. Under Solvency II, SST is a key tool within the risk management system, acting as a bridge between different aspects of risk identification, assessment, measurement, management and reporting. Typically, the responsibility for SST lies with the risk function with support from actuarial teams to model the various stresses and scenarios. This collaborative approach ensures that SST supports informed business planning and risk mitigation and embeds scenario analysis as an integral component of the risk management cycle.

At its core, we have the most simplistic type of stress, a point-in-time stress. In this case, the balance sheet is recalculated at a particular time point, typically ‘time zero’ (the balance sheet date), by stressing typically one variable. Point in time stresses are more narrowly defined, so the potential purposes for such stresses are more limited. Such stresses could include assessment of the impact upon or sensitivity of elements of the balance sheet to movements in a particular variable, such as an equity market index or the level or shape of the yield curve.

The complexity increases as we transition from point-in-time stresses applied to a single variable to simultaneously stressing a number of variables in a consistent way (i.e., generating a scenario) and looking at longer term projections of the resulting impact on multiple balance sheet items.

Stress and scenario calibration is a key aspect of SST. It is important that the severity of the stress/scenario in question aligns with the purpose of the test and the risk profile of the company. Furthermore, assumptions should be set realistically such that scenario results provide the (re)insurer with appropriate insight into its current and future risk profile. In effect, stresses and scenarios generally need to be considered plausible.

As mentioned in the introduction, different SST exercises throughout the year are often performed in isolation to one another, potentially leading to inefficiencies and inconsistencies. At the end of the day, there are many elements to an SST exercise. Understanding them is key when streamlining and consolidating requirements into a central log of descriptions and calibrations. In the remainder of this section, several of the main characteristics of stress and scenario selection are outlined. These will be used, later on in Section 3, to define the elements of the scenario testing framework.

2.2 IDENTIFYING THE PURPOSE

As a starting point, it is essential to clearly identify the objectives of each scenario or stress test. A well-understood objective ensures that each stress/scenario is designed to produce relevant and meaningful results. The goals may include, for example, evaluating the sufficiency of capital buffers under severe but plausible adverse events or understanding the impact of specific risks—such as market, operational or climate-related risks.

Ideally, for any particular stress/scenario that is run, it should be possible for it to fulfil a variety of purposes. Through a well-structured scenario testing framework, (re)insurers should be able to readily identify and eliminate overlapping outcomes, thereby helping to drive efficiencies across different SST exercises that need to be undertaken over the course of the year.

When designing appropriate stresses and scenarios, it is important to consider what needs to be defined to achieve the intended objectives of each exercise. (Re)insurers will tailor stresses/scenarios to business objectives and regulatory requirements depending on the task and will address various risk types, such as market risk, counterparty risk, underwriting risk, liquidity risk, operational risk, climate risk, etc. Establishing clear objectives at the outset provides valuable guidance for subsequent steps in the scenario selection process.

Scenarios should be sufficiently granular to provide meaningful insights, while avoiding unnecessary complexity that could obscure key messages or make modelling unmanageable. Understanding what a given scenario is trying to achieve will help to inform how complex the scenario is required to be. The level of granularity of the scenario design should align with the specific risk exposure of the company and the degree of interaction between different risks that might be captured as part of that scenario. In addition, clearly identifying which specific metrics need to be modelled is essential to ensure the exercise delivers actionable and relevant results, in an efficient manner (and not accompanied by unnecessary surplus information).

2.3 SELECT THE TIME HORIZON

The choice of time horizon should align closely with the specific purpose of the stress/scenario and the nature of the risks being assessed. For instance, short-term horizons are often suitable for evaluating immediate, acute risks, such as market shocks or operational disruptions, while medium- and long-term horizons can help assess evolving risks that manifest over several years. Long-term horizons are particularly important for analysing slow-moving events or emerging risks, such as those related to demographic shifts or climate change. Scenarios designed to demonstrate the impact of climate change on (re)insurers should consider both short- and long-term horizons. While the effects of physical climate-related risks may only fully unfold over decades, transitional impacts—such as regulatory changes, market shifts or operational disruptions—can materialise over much shorter time frames. As a result, scenario testing should include both immediate and medium-term climate scenarios, reflecting current regulatory expectations and best practice. By carefully matching the time horizon to the characteristics of the risks under consideration, scenario analysis can provide meaningful and actionable insights for both business decision making and regulatory compliance.

In some instances, the specific purpose of the scenario analysis may dictate the time horizon which needs to be considered as part of the SST exercise. Therefore, it is important to understand any regulatory constraints which may exist, as well as the needs and expectations of other relevant stakeholders in the scenario design stage. For example, under Article 45 of the the Solvency II Directive 2009/138/EC,[1] the ORSA is required to enable an insurer or reinsurer 'to properly identify and assess the risks it faces in the short and long term.'

2.4 SEVERITY

The severity of a given stress/scenario represents its impact on the position of the insurer—typically financial or liquidity—and might differ, depending on the purpose of the scenario. A reverse stress test, for instance, would generally require a much more severe stress than other types of scenarios included in the ORSA. Where the former is used to analyse how severe a stress should be such that it leads to failure, the latter is used to test whether an insurer's capital position is sufficiently robust to support the successful execution of its business plan.

A typical categorization of the severity of scenarios is as follows:

- **Mild**: represents minor adverse events or small deviations from normal conditions. Examples are a slight market downturn, minor operational disruptions, a small decrease in liquidity buffer.
- **Moderate**: involves more significant but still plausible adverse conditions. Examples are noticeable but not extreme market shocks, moderate cyberattacks, increases in longevity rates.
- **Severe**: represents extreme but still plausible scenarios, often reflecting historical worst-case events or regulatory requirements. Examples are major market crashes, large-scale cyberattacks or widespread system failures.
- **Extreme**: hypothetical or generally highly unlikely scenarios, often used in reverse stress testing to identify what circumstances would cause failure.

1. The full text of the Directive 2009/138/EC of the European Parliament and of the Council of 25 November 2009 on the taking-up and pursuit of the business of Insurance and Reinsurance (Solvency II) is available at https://eur-lex.europa.eu/eli/dir/2009/138/oj/eng.

Using these ranges, the 'Mild' and 'Moderate' scenarios are best suited for testing the (re)insurer's resilience in realistic circumstances, assessing minor impact management actions and to test if routine controls and procedures are sufficient. Examples of reports where these are included are the Solvency and Financial Condition Report (SFCR), annual report or strategic risk assessment (SRA).

The 'severe' and 'extreme' stress tests are best placed to test the limits of the (re)insurer's ability to withstand stress and to identify vulnerabilities. Severe scenarios may be used in, for instance, pre-emptive recovery planning, the liquidity risk management framework or reverse stress testing.

There are various ways to identify the severity of a scenario. Measures typically used are (1) The probability that the scenario occurs, (2) The impact the scenario has on the (re)insurer's financial or liquidity position or a combination of the two. The ranges used to determine in which severity category the scenario falls is discretionary.

In case the probability is used as a measure, an example range could be defined as follows:

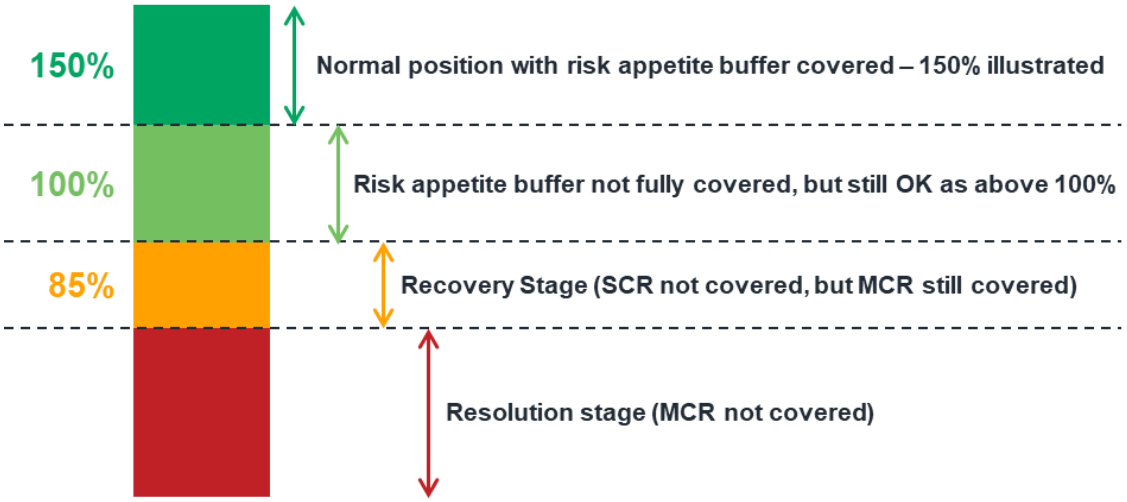
- **Mild**: Stress and scenarios with a 1-in-10-year probability.
- **Moderate**: Scenarios that occur on average once every 20 to 50 years.
- **Severe**: Scenarios that occur on average once every 200 years.
- **Extreme**: Scenarios that are expected to occur less often than 1-in-200 years.

In case the financial impact of a stress/scenario is used as a measure, an example range could be as follows:

- **Mild**: The solvency coverage ratio does not lead to a breach in risk limits.
- **Moderate**: The solvency coverage ratio is below risk appetite but still above 100%.
- **Severe**: The solvency ratio is below the resolution threshold, leading to a recovery situation.
- **Extreme**: The solvency ratio is below the resolution threshold, leading to a resolution situation.

The ranges are also illustrated in Figure 1.

FIGURE 1: EXAMPLE OF CATEGORISATIONS WHEN USING FINANCIAL IMPACT AS A MEASURE



If considering liquidity measures instead, such as the company's liquidity buffer, this approach can also be used, where a mild stress for instance leads to a liquidity buffer of less than three months, a moderate stress to a buffer less than one month and severe or extreme stresses to buffers less than one week or one day, respectively.

2.5 COMPLEXITY

Another dimension related to the purpose of each stress/scenario is the complexity of each defined scenario, meaning the number of risk exposures that are considered. With more risk factors considered, scenarios can become more realistic (or, at least, more consistent in the sense that there are corresponding adverse movements in related variables) but also harder to calculate and understand.

In terms of complexity, a distinction is typically made between univariate and multivariate stresses.

- **Univariate stress**: stresses that only consider one risk exposure. Focussing on one standalone risk, they are useful for rapidly assessing how vulnerable a company is to one particular risk. They are included in various risk reports, such the SFCR and ORSA, but are also used to determine for instance the capital requirements for standalone risks under the Solvency II Standard Formula. Results from univariate stresses are easier to explain, but they do not directly account for interactions between different risks. In capital requirement calculations these interactions are typically included using a correlation matrix or copula, aggregating single risks to approximate their joint effect. In scenario calculations, however, this is typically not the case. Instead, multivariate stresses are used.
- **Multivariate stress**: characterised by their use of multiple risk drivers. This allows for the creation of more intricate scenarios, such as an economic recession or major natural catastrophe. Scenarios such as these have broader ramifications and impact different risks simultaneously (e.g., equity, interest rates, property values, lapse rates). These are particularly useful when planning for long-term shocks or when non-linear interactions are considered.

When considering the required degree of complexity, users should carefully consider the purpose of these shocks. Univariate stresses might be sufficiently informative to assess the impact of certain events occurring in the short term. The required complexity will progressively increase though for more elaborate events.

2.6 RISK PROFILE

Identifying stresses and scenarios that focus on the key elements of a company's risk profile is essential for effective risk management. By selecting scenarios that are most relevant to the organisation’s specific exposures (or, indeed, potential exposures), insurers can ensure that scenario analysis is both targeted and meaningful.

It is important to recognise that the business plan is typically dynamic, influenced by a combination of internal and external factors. As the business plan evolves, the overall risk profile of the business itself may also shift. This means that risk exposures are not static; they change over time in response to the evolving business environment. Given this dynamic, it is crucial to regularly review and adjust scenario analyses in line with changes to the business and its operating environment. This ongoing process ensures that scenario analysis remains relevant and that emerging risks are appropriately captured, supporting both robust risk management and regulatory compliance.

Particular attention needs to be given to adjusting stresses and scenarios in order to uncover any unintended or hidden risks which may exist (and which may have only been brought about by changes to the business or its operating environment since the previous corresponding SST exercise was performed). An important aspect of risk management is understanding how different elements of the risk profile interconnect and interact. When conducting scenario analysis, it is possible for individual scenarios to indicate limited exposure or impact when considered in isolation. However, if two such scenarios were to occur simultaneously, their combined effect could result in a much more severe outcome. This potential for compounded risk may be overlooked if the analysis focuses solely on individual exposures, rather than considering how risks might aggregate or interact in practice.

When developing a scenario, it is essential for (re)insurers to ensure that all critical metrics which could contribute to risk concentrations are fully incorporated into the analysis, as this is something which can sometimes be overlooked. For instance, in the case of a (re)insurance subsidiary, the true level of risk exposure to the parent company may require the assessment of scenarios which impact both the parent and the subsidiary at the same time, even though the nature and extent of the impact on each entity may be quite different. This assessment helps to determine how risk concentrations may materialise across the broader group structure in times of stress and ultimately exacerbate the impact of any given scenario at the subsidiary level.

2.7 METHODOLOGY

Once the main characteristics of a stress/scenario are defined, the next step is to determine the methodology to quantify the impact. Various modelling techniques are used in stress testing. The use of a particular risk model will depend on the (re)insurer's circumstances and approach to risk assessment and risk management.

It is important that the methodology appropriately captures the (re)insurer's current and future financial position and risk profile and, at the same time, leads to results that are easy to understand and validate. The required complexity of the methodology might differ depending on the purpose of the SST. For univariate sensitivity testing, a more high-level approach might suffice, while scenario testing for ORSA purposes typically requires a more intricate calculation. In any case, it would be expected that a prudent, well-managed (re)insurer would regularly examine the quality and content of its SST and seek to continuously improve the methodology over time.

One of the main considerations is the choice of whether the stress/scenario should be defined as a point-in-time event or if it should be specified as an adverse event which continues to unfold over future time periods as well.

- **Point-in-time stress**: A point-in-time stress is applied on the current financial position of the (re)insurer and based on actual conditions such as current market prices, interest rates or credit ratings. A point-in-time stress can still run over multiple years. If this is the case, the stress is still defined only at balance sheet date, and the future financial position of the company is the result of the stress and its impact which occurred at that date.
- **Long-term stress**: The stress/scenario is defined over a longer time period, for instance the business planning period. Both actual conditions and longer-term stressed conditions are set for this type of calculation to see how the financial position of the (re)insurer and wider economy would perform under a stress that runs over a longer period.

Another consideration needs to be made as to how granular the calculation methodology should be. In practice, we see two approaches being used:

- **Risk driver approach**: The balance sheet is stressed at valuation date. The future financial position is determined by projecting the balance sheet, profit and loss statement (P&L) and capital requirements using pre-defined risk drivers.
- **Full calculation**: The financial position is fully recalculated at the valuation date, as well as periodically over the course of the future projection period.

A full calculation can be quite cumbersome. In practice, many companies therefore choose a risk driver approach as they deem it sufficient for the purposes of SST (e.g., gaining insight into their risk profile).

Finally, a distinction can be made between deterministic and stochastic models. Deterministic models examine the financial impact if a certain scenario occurs, whereas stochastic models also take into account the probability of various scenarios occurring. In general, deterministic models are used for SST as the scenario to be calculated is already defined, removing the need for a stochastic model. Stochastic models, however, can still be of added value in SST. In practice, we see (re)insurers using these models to calculate a set of mostly economic scenarios and, based on their results, analyse the outliers to get a better understanding of the risk profile.

2.8 ASSUMPTIONS

Setting appropriate assumptions is another key element for the quantification of a stress/scenario. Together with the methodology, they implicitly determine the SST's result. Several considerations apply when calibrating the stresses/scenarios.

The SST should for instance ideally cover all areas of uncertainty that materially could impact the (re)insurer's position. These areas of uncertainty are typically represented by one or more risk drivers. Longevity risk can for instance be represented by a shift in base mortality and improvement rates. Strategic risk can be represented by decreasing new business volumes and margins. Consideration should be given as to whether these risk drivers appropriately reflect the (re)insurer's risk profile.

Another consideration is the structure of risk drivers. For example, should changes to interest rates vary by term, will a parallel shift in the yield curve suffice, or should both be used? Also, it is necessary to consider consistency across different variables. For instance, if interest rates rise, this could impact lapses or new business volumes due to affordability, depending on the type of product.

Next, certain underlying assumptions (such as the assumption that markets are perfectly correlated) are likely to be required for most stresses/scenarios, and these will need to be documented.

The calibration of the risk drivers and assumptions is another area for consideration. Two potential approaches are the (1) historical approach and (2) forward-looking approach.

- In the historical approach, stresses are solely based on the events and/or conditions which have been observed in the past. This approach is only able to re-propose, maybe in different combinations, events that have already materialised.
- In the forward-looking approach, the level of stress is set independently from historical events and/or conditions and based on expert judgement.

Which approach to use depends on the use of the scenario. A historical approach can be used, for example, to benchmark the (re)insurer's resilience in a past event. The forward-looking approach can result in more tailored future scenarios. A hybrid approach is also possible. This allows inclusion of events which haven't necessarily been experienced to date (either at all, or at a given level of severity, or there is not enough data available for a sufficient calibration) or unexpected combinations of shocks that originate from historical observations, while maintaining plausibility and consistency with past events.

Another assumption to consider is the speed at which a scenario develops. Scenarios do not always develop overnight. Instead, they can also develop in a slower pace, for instance over the course of a few months or even years. In SST, a distinction is typically made between fast-moving and slow-moving scenarios:

- **Fast-moving**: A situation or crisis that escalates or changes rapidly, with a high impact and requiring immediate and decisive action to prevent significant harm or loss. These scenarios are characterised by their speed, unpredictability and potential to overwhelm standard response procedures if not addressed quickly. Examples are a cyberattack, market crash or natural disaster.
- **Slow-moving**: A situation that develops over time, giving organisations the chance to observe, analyse and respond proactively. Examples are an economic downturn, regulatory changes or increased competition.

The speed of the scenario is relevant, for instance, for evaluating the effectiveness of risk indicators and management actions. A fast-moving scenario demands swift, pre-planned management actions to help mitigate damage more effectively. Slow-moving scenarios allow for timely interventions and management actions that take longer to implement, minimising long-term impacts. Reports such as pre-emptive recovery plans[2] therefore require the inclusion of both fast- and slow-moving scenarios.

There are several other considerations when setting assumptions for the quantification of SST. Further insights in these can be gained from the European Insurance and Occupational Pensions Authority's (EIOPA's) paper *Methodological Principals of Insurance Stress Testing*[3] or from the Milliman paper entitled *Recommendations for developing a Stress and Scenario Testing framework*.[4]

2. Central Bank of Ireland. (April 2021). Recovery Plan Guidelines for (Re)Insurers. Retrieved 12 November 2025 from https://www.centralbank.ie/docs/default-source/regulation/industry-market-sectors/insurance-reinsurance/solvency-ii/requirements-and-guidance/recovery-plan-guidelines-for-(re)insurers.pdf.
3. European Insurance and Occupational Pensions Authority. (4 December 2019). Methodological principals of insurance stress testing. Retrieved 12 November 2025 from https://www.eiopa.europa.eu/system/files/2020-03/methodological-principles-insurance-stress-testing.pdf.
4. Hutchinson, E., & Vosvenieks, F. (15 February 2019). Recommendations for developing a Stress and Scenario Testing framework. Milliman. Retrieved 12 November 2025 from https://www.milliman.com/en/insight/recommendations-for-developing-a-stress-and-scenario-testing-framework.

2.9 REFLECTING MANAGEMENT ACTIONS

(Re)insurers often have specific strategies or interventions prepared, which they intend to implement in response to stressed scenarios in order to mitigate or limit the realisation of particular risks. Recognising these intended actions allows companies to more accurately reflect their risk management capabilities and preparedness within their SST exercises. When integrating future management actions into models used for stress and scenario calculations, several important considerations must be addressed.

It is essential that the impacts of management actions are clearly and separately identifiable within scenario analysis. This allows insurers to evaluate how effective these actions are under stressed conditions, recognising that their efficacy may be limited in certain adverse circumstances. By separately identifying the impacts of management actions, firms can examine their specific contribution to mitigating adverse outcomes during a scenario analysis. For instance, consider a lapse scenario where management responds by deploying a customer retention strategy. While such a strategy is intended to reduce the number of lapses, it is important to assess its real-world effectiveness. There is often a lag between the implementation of the retention strategy and the observable decline in lapses. If the effect of the management action is separately tracked, the insurer gains a clearer understanding of how the action performs in the model compared to how it might perform in practice.

Careful consideration should be given to how management actions are incorporated into models, ensuring they remain distinguishable in each model run or scenario. If the model is set up so that the impact is clearly identifiable, then the same scenario can be more readily used in different SST exercises. As for some purposes, it may be important to examine adverse impacts without any mitigating management actions, whereas, in other cases, the impact of the management itself may be of equal importance. This will ultimately lead to greater efficiency within the scenario testing framework.

Clearly, it is also important that management actions themselves do not prevent the intended scenario from manifesting in the first place, i.e., the management action should really only kick in once the adverse event which is being considered has already occurred, allowing for a realistic time frame for implementation of the management action. Otherwise, this would inhibit any meaningful analysis being completed on the potential impacts of the stress/scenario as well as the effectiveness of the associated management actions.

2.10 OPERATIONAL

The preceding sections have considered SST in the context of assessing balance sheet resilience. However, there is another quite distinct use of scenario testing that is much more operational in nature. Although this is not the primary focus of the framework that we propose in this paper, it is nonetheless worth considering in the context of such a framework.

There are a number of practical applications of scenario testing when it comes to operational-level events, the primary one being operational risk management. In particular, the measurement of operational risk exposure (in economic capital terms) is often dependent on scenario analysis. Operational scenarios which include events such as system failures, cyberattacks or process breakdowns are often key building blocks within internal economic capital models. Not only can these scenarios be used to measure capital requirements, but they can equally be applied to the assessment of business continuity and operational resilience. This offers two interesting opportunities, as follows:

- By carefully expanding the scope of existing operational risk scenarios, companies may also be able to satisfy their operational resilience scenario testing requirements (without needing to run a separate exercise), thereby creating a valuable synergy. This may, in turn, lead to more developed operational risk scenarios, which may generate broader insights into the potential sources of operational risk losses.
- Linking operational risk and operational resilience scenarios helps to strengthen the association between resilience and financial performance and aid broader understanding of how one affects the other.

Many of the concepts outlined in this paper may be applied in the context of operational risk and operational resilience scenario testing, both of which can benefit from a structured approach to scenario selection.

3 Outlining the framework

The example inventory includes an example (based on public information, available in several reports published by insurance groups throughout 2024[5] [6] [7] [8]) of how the proposed scenario testing framework can be applied in practice.

The following sections outline the structure of the testing framework, its key components and how these can be determined.

3.1 RISK INVENTORY

The scenario testing framework consists of two parts: a risk inventory that shows the (re)insurer's key risk exposures and its view on these and an overview of the scenario calculations performed in the past, including their key characteristics.

As we will show later on in Section 3.7, the inclusion of a risk inventory enables the framework to be of added value in terms of completeness and relevance of the stress and scenario calculations. It also allows for the chosen stresses/scenarios to be further integrated into the wider risk management cycle. The risk inventory consists of the following components:

Key risk exposures:

The risks the (re)insurer is exposed to that it considers are key in its risk management and monitoring. In most cases, key risk exposures are part of the risk appetite and have their own risk limits and indicators. In the example inventory, the key risks included are the main strategic, financial and non-financial risk exposures identified by the (re)insurer.

(Re)insurers usually already have a risk inventory in place. These inventories are typically quite exhaustive and include both major and minor risk exposures and risk exposures that are similar in nature. The purpose of the risk inventory in the scenario testing framework, however, is not to have an exhaustive list of risk exposures but instead only to list the key risk exposures that should be covered by SST.

Risk classes:

The key risk exposures identified are mapped to their corresponding risk classes. Examples of risk classes are market risk, underwriting & pricing risk and business operating risk. As an example, consider a 'global financial crisis' scenario with the following qualitative description: '*As a result of the financial crisis, equity markets crash and bond spreads widen. Businesses and/or consumers not being able to pay their debt leads to higher lapses*.' Here, risk classes such as 'market risk,' 'credit risk' and 'underwriting & pricing risk' could for instance apply.

Risk categories:

Each key risk exposure in the risk inventory is assigned to one of the following three main categories, based on its characteristics:

- **Univariate risks**: risk exposures that can be quantified in isolation. In SST they are included through their own dedicated risk drivers and by setting their corresponding parameters to a scenario-appropriate value. Examples of such risk exposures are interest rate, expense and lapse risk, where interest rate risk for instance can be included through a parallel shift in the yield curve.
- **Multivariate risks**: Strategic risks such as the risk of increasing competition or non-financial risks such as conduct risk are usually not quantified using a single risk driver but instead through multiple other risk drivers. The impact of conduct risk can for instance be tested by combining a lapse stress following reputational damage and a one-off financial impact resulting from a fine by the supervisor.

5. NN Group. (2024). Annual Report 2024. Retrieved 12 November 2025 from https://www.nn-group.com/investors/annual-reports/2024.
6. Aviva plc. (31 December 2024). Aviva plc Single Group-wide SFCR: Solvency and Financial Condition Report 2024. Retrieved 12 November 2025 from https://www.aviva.com/investors/regulatory-returns/.
7. SCOR. (20 March 2025). SCOR SE announces the availability of its 2024 Universal Registration Document [Press release]. Retrieved 12 November 2025 from https://www.scor.com/en/press-release/scor-se-announces-availability-its-2024-universal-registration-document.
8. Generali Group. (2025). Emerging and Sustainability Risks Booklet. Retrieved 12 November 2025 from https://www.generali.com/sustainability/emerging-risks.

- **Exposures that can be grouped**: For especially non-financial risks, it holds that there can be various exposures that are treated in a similar way when quantified in scenario calculations, even if qualitatively they are different in nature. Examples are conduct risk, operational risks and business continuity risks. An internal system error due to a cyberattack or losing access to systems due to a long-term power outage can both be captured in a scenario through an increase in lapse rates, lower new business volumes, a higher expense basis and the incurrence of a one-off expense.

Risk classification:

For each key risk exposure, the inventory reflects the importance of that exposure in the SST exercise in question. There are three classes defined in the framework:

- **High**: risks to which the (re)insurer has a high exposure and which have a material impact that should be included in most of the stress and scenario tests and most of the reports mentioned in Section 2. An example would be interest rate risk for an insurer with a large book of life business. Another example could be natural catastrophe risk for a property and casualty (P&C) reinsurance company. In both cases, it is likely that these exposures play a central role in reports such as the ORSA, SFCR and annual report.
- **Medium**: risks with a lower overall exposure and a less material impact, for which it is sufficient if they are included in only a few scenarios. An example of this could be default risk in cases where an insurer has a large reinsurance cover in place with a reinsurer. Whilst the probability that the reinsurer defaults is typically low, the impact of such an event is material. For the purposes of SST, including this risk exposure in one or two scenarios could provide the insurer with sufficient insight to better understand and manage the risk.
- **Low**: risks with a lower exposure and low impact, for which it is sufficient if they are covered by only one scenario or sensitivity. One example of a ‘Low’ classified risk is concentration risk. Although (re)insurers have to hold capital for it, there might not be the need to stress it separately in the SST. We want to stress that judging the need for testing comes from experience from past exercises and should still be periodically reviewed to make sure this still applies. At a minimum, the decision not to include a ‘Low’ classified risk should be well documented with justification so that this can be challenged if necessary.

Risk view:

The (re)insurer’s view of the extent of each of its key risk exposures may change over time. It can be the case, for example, that property risk exposure was classified as a ’High’ previously but is regarded as ’Low’ now due to a disinvestment of real estate. If the (re)insurer has reinvested the proceeds in, say, government bonds, it may lead to spread risk exposure increasing from ‘Medium’ to ‘High.’

The risk inventory also provides insight into changes in risk classifications over time. This is achieved by not only including the current risk classifications of all key risk exposures identified but also including the corresponding classifications from the previous year.

Completeness check:

Finally, the risk inventory also contains a completeness check, verifying whether the key risk exposures are sufficiently covered by the scenario calculations performed. More detail on this completeness check is included in Section 3.7.

3.2 EXAMPLE: POPULATING THE RISK INVENTORY

The example inventory includes a risk inventory covering various types of risk exposure. The list of key risk exposures in this example was curated by combining the risk appetite statements and key risk exposures included in the various public reports referenced in the Introduction section of this paper. Several expert judgements were applied though, taking into account the purpose of the various fields in the risk inventory and their applications in the scenario testing framework:

Key risk exposures identified:

At the highest level, risk exposures can be classified as strategic, financial or non-financial in a (re)insurer’s risk appetite framework.

- **Strategic risks**: represent future events that affect the viability or execution of the insurer’s business strategy and can be considered as scenarios in their own right. Examples include the risk of geopolitical instability or a more competitive market. As strategic risks included in the risk appetite are typically quite distinct from each other, we decided to include these risks on a standalone basis in the inventory.

- **Financial risks**: are risk exposures that impact the solvency and/or liquidity position of the (re)insurer. Examples include equity risk, expense risk, longevity risk and liquidity risk. Most of these risks are univariate in nature, meaning they can be quantified on a standalone basis in stress calculations. They are therefore also included as such in the risk inventory.
- **Non-financial risks**: are risk exposures that are not directly related to financial losses. Instead, they impact the (re)insurer's reputation, operations, compliance and/or overall sustainability. As mentioned previously, there are many non-financial risks that are quantified in a similar way in scenario testing. Instead of listing each individual non-financial risk exposure in the risk inventory, they are therefore grouped into several distinct types of non-financial risks, such as business conduct risk and operational risk.
- Note these risks are grouped to keep the risk inventory somewhat concise and user-friendly. Listing the non-financial risks separately and not grouped, however, does have the benefit of providing a deeper understanding of different paths in which these scenarios can emerge.

Risk classes:

The classes 'strategic,' 'financial' and 'non-financial' are considered too high level for the classification of scenarios in the framework. Financial risks for instance include market, credit, liquidity and underwriting risk exposures. Not having these defined as separate risk classes leaves the user of the scenario inventory unable to make a distinction between market risk and socio-economic scenarios.

For the purposes of identifying and classifying scenarios, more detailed risk classes are therefore required in the risk inventory. Financial risks are, for instance, subdivided into market, credit, liquidity, life underwriting & pricing, and non-life underwriting & pricing risk. As set out in Section 3.3, when classifying scenarios applying these classes, defining them at this level provides sufficient granularity, whilst maintaining a somewhat concise inventory.

Risk categories:

The various key risk exposures identified are also mapped to their appropriate risk categories. For strategic risks, it holds that they are multivariate. The 'business strategy risk' exposure, for instance, represents the risk that the (re)insurer's strategy is not well executed, causing the (re)insurer to fall behind competition. It includes factors such as lower new business volumes, higher lapse rates and higher expenses bases. Financial risks are all of the univariate type. Non-financial risks are all classified as exposures that can be grouped.

FIGURE 2: SNAPSHOT OF THE POPULATED RISK INVENTORY IN THE EXAMPLE INVENTORY

Risk inventory & checks

1. Risk inventory

				Risk classification	
				Current	Previous
Risk ID	Key Risk	Risk Class	Risk category	31/12/2024	31/12/2023
1	Business strategy risk	Internal strategic	Multivariate	High	High
2	Macroeconomic risk	External strategic	Multivariate	Medium	Medium
3	Economic Cycle & Financial Crisis	External strategic	Multivariate	Low	Low
4	Geopolitical risk	External strategic	Multivariate	Medium	Medium
5	Legal & Regulatory developments	External strategic	Multivariate	Low	Low
6	Competitive Environment	External strategic	Multivariate	Medium	Medium
7	Interest rate risk	Market	Univariate	Medium	Medium
8	Equity level risk	Market	Univariate	Medium	Medium
9	Equity volatility risk	Market	Univariate	Low	Low
10	Currency risk	Market	Univariate	Low	Low
11	Real estate risk	Market	Univariate	Low	Low
12	Concentration risk	Market	Univariate	Low	Low
13	Inflation risk	Market	Univariate	Medium	Medium
14	Spread widening risk	Credit	Univariate	High	Medium
15	Reinsurance default risk	Credit	Univariate	Low	Low

3.3 SCENARIO INVENTORY

The scenario inventory is the main component of the scenario testing framework. It provides an overview of stress and scenario analyses previously performed, their main characteristics, applications and surrounding governance. It encourages the re-use of scenario calculations for different purposes, where appropriate, and explicitly links the scenario calculations to the risk inventory, encouraging the user to ensure that the scenario calculations are consistent with the (re)insurer's risk profile and current view on risk. The scenario inventory consists of the following components:

Scenario name:

The first element of the inventory is the scenario name. The name should be specified such that it provides a high-level overview of what stress or sensitivity is represented by the scenario. Examples of scenario names are '50 bps increase in interest rate' in case of a univariate stress or 'Climate change & natural catastrophes' in case of a multivariate stress.

Scenario description:

is a qualitative description that provides a high-level overview of the scope of the scenario (e.g., which events take place) and the application (e.g., how are these events included through stressed key risk exposures applied). The purpose of this description is not to provide an exhaustive scenario description but instead to enable the user to make an initial selection of scenarios they want to use or compare in their scenario calculations. The parameterisation of each scenario is included in separate components later in the scenario inventory. It is not therefore necessary to have this included in the description.

An example of a description for a 'Global financial crisis' scenario could be as follows: 'As a result of the financial crisis, equity markets crash and bond spreads widen. Businesses and/or consumers not being able to pay their debt leads to higher lapses and lower new business volumes.'

Complexity:

This component indicates whether the scenario represents a univariate stress or a multivariate stress, in line with the definitions included previously in Section 2.5:

- **Univariate stress**: scenario calculations focussing on one standalone risk
- **Multivariate stress**: scenario calculations characterised by their use of multiple risk drivers

Application:

Here, we indicate how the stress is applied. There are two options to choose from:

- **Point-in-time**: The stress is applied on the current financial position of the insurer and based on actual conditions, such as current market prices, interest rates or credit ratings.
- **Long-term stress**: The stress/scenario is defined over a longer term, for instance the business planning period.

More information on the uses of point-in-time stresses and scenarios can be found in Section 2.7.

Time horizon:

The framework distinguishes between three distinct time horizons:

- **Current position**: Only the impact of the stress on the financial position at the balance sheet date is considered. For instance, what is the impact of a 50bps spread widening on the (re)insurer's balance sheet at the balance sheet date? This type of stress does not have a forward-looking element and is used to evaluate the immediate resilience to fast-moving stresses.
- **Business plan**: The impact of the stress is evaluated across the strategic business planning period, typically three to five years. It is commonly used in reports such as the ORSA or pre-emptive recovery plan.

- **Exploratory**: Some risks are expected to manifest beyond the business planning period. Examples include the impacts of climate risk or digitalisation. For these scenarios, it makes sense to evaluate the financial position of the (re)insurer over a longer period of time. The 'Fit-for-55' climate scenarios from the European Systemic Risk Board (ESRB)[9] for instance require a projection horizon beyond the business planning period.

Please note that the 'Application' and 'Time horizon' scenario characteristics are not, by definition, directly related. It can for instance be the case that the (re)insurer decides to assess a scenario across the business planning period by applying a point-in-time stress. In fact, this is a simplified approach, which is applied in practice by several companies in their ORSA reports.

Referring back to Section 2.3, the 'current position' represents a short-term horizon, the 'business plan' represents a medium-term horizon, whilst the 'exploratory' horizon corresponds to a long-term horizon. Note that the user of the framework is free to change the time horizons applied to what best suits the requirements of the SST exercise in question.

Speed:

The speed at which a scenario develops. In line with Section 2.8, a choice can be made between the following:

- **Fast-moving**: a situation or crisis that escalates or changes rapidly, with a high impact and requiring immediate and decisive action to prevent significant harm or loss
- **Slow-moving**: a situation that develops over time, giving organisations the chance to observe, analyse and respond proactively

Severity:

The framework distinguishes between three levels of severity, as follows:

- **Target operating range**: severe but plausible scenarios to assess how risks could impact the financial position of the company. Scenarios of this severity can be used to determine whether the company remains within its key limits and internal targets, for instance the Solvency ratio. In the example inventory, scenarios are assigned to this category as long as the insurer's recovery threshold is not breached. For most insurers, it holds that this recovery threshold is set equal to a Solvency ratio of 100%. Note, though, that it can also be set to a different (higher) threshold.
- **Recovery**: scenarios that lead to a potential crisis or failure due to the breach of their recovery threshold and require management actions to get back to the target operating range. Scenarios that are in this category are severe enough to breach the recovery threshold but not the resolution threshold.
- **Resolution**: in the most extreme scenarios, the resolution threshold is breached. In recovery and resolution planning, this is the point where there are no actions left for the (re)insurer to get back to a going-concern situation within a reasonable amount of time. The resolution threshold is set at the individual company level.

Note that the user of the framework could also decide to add a step in between the 'target operating range' and the 'recovery' trigger. If the target operating range is, say, 150% and the recovery trigger is 100%, the additional layer could be 130%. Dropping below this level wouldn't necessarily trigger a recovery plan but would likely set off some early warning indicators.

In the previous classification, we use the Solvency ratio as a reference to determine the severity of a given stress/scenario. Other measures, such as the liquidity buffer or operational risk indicators, can also be used for this purpose. Of course, one can also decide to use a different measure instead. The CRO Forum paper, *ORSA Stress and Scenario Testing*,[10] for instance uses the likelihood of the scenario. Here, scenarios are classified as 'High likelihood, lower severity,' 'Lower likelihood, higher severity' and 'Very low likelihood.' Defining the likelihood of the scenario can be tricky, however, especially for multivariate scenarios that include strategic or non-financial stresses and for scenarios that are new or evolving like climate or cyber risk scenarios.

9. European Insurance and Occupational Pensions Authority. (19 November 2024). Transition risk losses alone unlikely to threaten EU financial stability, "Fit-For-55" climate stress test shows. Retrieved 12 November 2025 from https://www.eiopa.europa.eu/transition-risk-losses-alone-unlikely-threaten-eu-financial-stability-fit-55-climate-stress-test-2024-11-19_en

10 CRO Forum. (2023). ORSA Stress and Scenario Testing: Best practice for assessing risks. Retrieved 12 November 2025 from https://thecroforum.org/wp-content/uploads/2023/02/CRO-ORSA-stress-and-scenario-testing.pdf.

Time stamp:

The valuation date or starting point of the scenario. In Section 3.7 this information is combined with the information in the risk inventory to check whether a scenario is still up to date and consistent with the (re)insurer's current risk profile.

FIGURE 3: SNAPSHOT OF THE POPULATED SCENARIO INVENTORY IN THE EXAMPLE INVENTORY

Scenario inventory

#	Stress & scenario name	Scenario description	Complexity	Application	Time horizon	Pace	Severity	Timestamp
23	Regulatory environment	The company is at risk of adverse regulatory changes due to political shifts and increased supervisory scrutiny and ambitions. This leads to a profound impact on the business model, performance and ability to deliver innovation and strategic initiatives. Examples of these changes are, among others, more severe Solvency II regulation, scrutiny on the internal model and extensive sustainable finance legislation. This leads to lower new business volumes, a higher expense basis, and an increase in overall capital requirements.	Multivariate	long-term	business plan	Slow moving	Target range	30/07/2024
24	Global debt crisis (2011 recession)	The scenario is defined as a higher interest rate environment, with debt levels further increasing, potentially leading to defaults or downgrades, as well global recession with negative GDP growth and high unemployment.	Multivariate	long-term	business plan	Fast moving	Recovery	30/07/2024
25	Global financial crisis (2008 recession)	As a result of the financial crisis, equity markets crash and bond spreads widen. Businesses and/or consumers are unable to repay their debt, leading to higher lapses and lower new business volumes.	Multivariate	long-term	business plan	Fast moving	Resolution	30/07/2024
26	Climate change – transition risk for assets	Due to climate change and the corresponding increasing regulations to tackle it, insurers are required to restructure their investment portfolios and invest more in ESG-assets. The required revised investment mix, leads to the risk of financial losses to investments and lower investment returns resulting from the transition to a lower-carbon/green economy.	Multivariate	long-term	exploratory	Slow moving	Target range	15/08/2024
27	Sustainable cost levels	In this scenario, expense and claims levels remain at too high a level for both the inforce book (not managing cost in line with runoff of the books) and new products. This leads to a higher new business strain and on the longer run, lower new business volumes as the company is not able to successfully compete with its direct competitors.	Multivariate	long-term	business plan	Slow moving	Target range	15/08/2024
28	Geopolitical instability	This scenario considers the escalation of geopolitical tensions in the world, which may lead to economic impacts (e.g. disruption of supply chains, trade tariffs, availability of resources) for Europe as well as diversion of resources to military goals (e.g. increased NATO spending). Risks associated with these tensions are an increased expense basis, recessionary environment on the markets and a lower appetite for investment type life products.	Multivariate	long-term	business plan	Fast moving	Target range	15/08/2024
29	Being outrun by competition	In this scenario, the company is not meeting changing customers' expectations, and is unable to transform the business with respect to market trends (including, among other things, AI, customer expectations and changing markets). This leads to lower new business volumes across the board and an increased expense base.	Multivariate	long-term	exploratory	Slow moving	Target range	15/08/2024
30	Longevity risk	In this scenario, the assumptions about life expectancy and mortality rates are set inaccurately due to advances in medical research or improving health conditions.	Multivariate	long-term	exploratory	Slow moving	Target range	30/07/2024

Risk classes:

The risk classes in scope of the scenario calculations. In the scenario inventory, all classes that are included in the calculations are marked as 'x.' The same classes are used here as in the risk inventory. This ensures consistency between the risk inventory and scenario inventory and, by doing so, also achieves consistency between the scenario inventory and risk appetite.

Having an overview of which risk classes are stressed in each scenario facilitates a quick and easy comparison between the scenarios in the inventory. As is shown later in Section 3.7, it is also used to check whether the stress and scenario calculations sufficiently cover the (re)insurer's key risk exposures identified in the risk inventory.

The risk classes used in the risk inventory are the same as the ones in the scenario inventory (Section 3.3). They are used to classify stresses/scenarios based on their qualitative description. This makes for an easier comparison between stresses/scenarios in the inventory and helps the user when quantifying their impacts.

Scenario categories (optional):

Some companies also classify their scenarios using categories that are not directly related to the risk exposures in their risk appetite. Examples of these applications are the CRO Forum's Emerging Risk Radar[11] and Generali's Emerging and Sustainability Risks Booklet [8]. In the latter, scenarios are categorised using a so-called 'PESTLE' classification, with risk classes 'Political,' 'Economic,' 'Social,' 'Technology,' 'Legal' and 'Environmental.' For the purposes of the example included in the example inventory, we do not include such an additional categorisation. The risk classes as defined here are considered sufficient for the purposes of our proposed framework.

11. CRO Forum. (2025). Emerging Risks Initiative: Major Trends and Emerging Risk Radar. Retrieved 13 November 2025 from https://thecroforum.org/wp-content/uploads/2025/07/ERI-Risk-Radar_2025.pdf.

Governance (optional):

In case various teams and departments participate in SST, it can be of added value to include some details around governance in the scenario inventory. Which persons, teams and departments were responsible for the production of the scenario, who were involved in the review, and who is responsible are key items of information. This can be especially helpful in case the scenario framework is used at the group level, with SST simultaneously taking place across business units and at the group level. Categories included can for example include 'Production,' 'Review,' 'Ownership' and 'Business Unit.' The example inventory does not include information around governance as it is not a prerequisite for the framework to function appropriately.

Financial impact:

The impact of the scenario on the main metric(s) of the (re)insurer, for instance the Solvency Capital Requirement (SCR) coverage ratio or liquidity buffer. Including these impacts helps users of the framework to select scenarios, to answer senior stakeholder questions on the risk profile and to get a sense of what a likely outcome would be in case (parts of) scenarios are re-used.

Application:

This section of the scenario inventory outlines the current and potential uses of stress and scenario calculations. Per scenario, the following is included:

- **Current uses**: the report or analysis for which the scenario calculation is currently used. Note that one scenario can have multiple current uses. In case of a univariate stress, it can for instance be the case that it was used for both the SFCR, Regular Supervisory Report (RSR) and annual report.
- **Future uses**: an overview of potential future uses for the scenario. In practice, companies may, for example, use their ORSA scenarios as a starting point for the pre-emptive recovery plan scenarios.

The example inventory includes a non-exhaustive list of applications, where current uses are marked as 'xx' and future uses as 'x.' One example is the 'global financial crisis' scenario. It is currently used in the ORSA. Due to it being a relatively severe scenario, it can also usefully be used in pre-emptive recovery planning. Finally, as 'Economic Cycle & Financial Crisis' is included as a key risk exposure in the risk inventory, the 'global financial crisis' scenario could also be used in the (re)insurer's SRA. In the scenario inventory, the ORSA is therefore marked as 'xx' and both the recovery plan and SRA as 'x.'

FIGURE 4: SNAPSHOT OF THE POPULATED SCENARIO INVENTORY IN THE EXAMPLE INVENTORY

Scenario inventory

	Stress & scenario name	Risk classes										Finncial impact	Application						
		Strategic - Internal	Strategic - External	Market	Credit	Liquidity	Underwriting & pricing Life	Underwriting & pricing Non-Life	Conduct	Business operating	Business technology	Business continuity	SCR ratio impact	SFCR	RSR	SRA	ORSA	Recovery Plan	Capital mgmt plan	Liquidty mgmt plan
23	Regulatory environment		x				x	x		x			7%				x			
24	Global debt crisis (2011 recession)		x	x	x	x							-43%				x	x		
25	Global financial crisis (2008 recession)		x	x	x	x							-85%			x	xx	x		
26	Climate change – transition risk for assets		x	x									-36%			xx	x	x		
27	Sustainable cost levels	x					x	x					-23%			xx	x			
28	Geopolitical instability		x	x	x	x	x	x					-14%				xx			
29	Being outrun by competition	x	x										-18%			xx	x			
30	Longevity risk						x						-12%			xx	x			

Risk drivers:

The quantification of each scenario is captured by listing the parameterisation of each stressed risk driver underlying the scenario calculations. By doing so, the scenario inventory provides both insight and oversight on several levels:

- **Risk classes**: Each risk driver is mapped to its appropriate risk class, as defined earlier in both the scenario and risk inventories. This allows for an easy identification of which risk categories are impacted by a given scenario. It also provides an additional option to select and compare scenarios.
- **Risk drivers**: Having parameter information at the risk driver level allows for a quantitative comparison between scenarios. As risk drivers are included in the inventory on a more granular level than risk classes, more detailed comparisons can be made between scenarios. Also, using existing calculations as a basis for new stresses/scenarios can lead to further consistency between SST calculations.
- **Risk profile**: High-level checks are included that compare the parameterisation of stresses/scenarios with the current risk profile of the company. These checks can help with identifying whether stresses/scenarios are still consistent with the current risk profile or not, and whether or not they need to be updated when being re-used.

It can be the case that some risk classes do not need to be included in the risk driver overview. Some risk classes are qualitative in nature and do not have their own unique risk drivers. Examples include conduct risk and regulatory risk. Conduct risk can for instance be quantified using the combination of increasing lapse rates and a one-off expense. In the example inventory, lapse rates are already part of 'Life underwriting & pricing risk,' and a one-off expense is included as an 'Operational risk' driver.

Note that the list of risk drivers included in the example inventory is purely indicative.

FIGURE 5: SNAPSHOT OF THE POPULATED SCENARIO INVENTORY IN THE EXAMPLE INVENTORY

Scenario inventory

#	Stress & scenario name	New business volumes	New business margins	Fixed Expense basis	Interest	Equity level	Equity volatility	Currency	Real estate	Concentration	Expense Inflation	Benefit Inflation	Spread wideing
	Risk ID	1		1	1	7	8	9	#	#	#	#	#
		Strategic risk			Market risks								Spread risks
24	Global debt crisis (2011 recession)	-20%			+100bps						+2%	+2%	+100bps
25	Global financial crisis (2008 recession)	-30%			+75bps	-25%	+20%	-10%	-10%		+1.5%	+1.5%	+50bps
26	Climate change – transition risk for assets			+2% Asset Mgmt expenses		-10% YoY returns			-10% YoY returns				
27	Sustainable cost levels	y2: -10%, y3: -15%, y4>: -20%		+10%									
28	Geopolitical instability	UL & IL y1: -25%, y2: -25%, y3: -15%			+50bps	-10%	+10%		-5%		+2%	+2%	+50bps

3.4 EXAMPLE: POPULATING THE SCENARIO INVENTORY

The example inventory includes a scenario inventory with various stresses and scenarios that have previously been used. In this section, we include an example of how to populate this inventory. Consider a (re)insurer that has recently performed an inflation risk scenario as part of its SRA, which it wants to add to the inventory. The valuation date was 2025Q2 and the qualitative description of the scenario is as follows:

'In this inflation scenario, persisting inflation levels occur, driven by a combination of geopolitics, higher energy and commodity prices, and scarcity in some production factors, leading to higher costs for households, businesses and economic growth. This leads to an increase in both expense and benefit inflation, as well as a lower appetite to purchase life insurance policies.'

The scenario is included in the inventory, in line with the characteristics outlined in the previous section.

- **Scenario name**: persistent inflation risk.
- **Scenario description**: persisting inflation levels lead to an increase in both expense and benefit inflation, higher lapse rates and a lower appetite for life insurance policies.
- **Complexity**: multivariate, as multiple risk exposures are impacted in the scenario.
- **Application**: long term, as the risk exposures are stressed over a period of time.
- **Time horizon**: business planning period.
- **Pace**: fast-moving. Although persistent, high inflation rates already occur at the start of the scenario.
- **Severity**: target range. The scenario is used to test the resilience of its business plan in an inflationary scenario. Although the scenario has a material impact, it does not lead to a recovery or resolution situation.
- **Time stamp**: 30/07/2024 (the calculation date).
- **Risk classes**: 'strategic – external,' 'market,' 'Life underwriting & pricing.' The 'strategic – external' risk class is selected, as 'Macroeconomic risk' is identified as one of the key risk exposures within this class, in the risk inventory. Inflation risk is part of the 'market' risk class. Lapse rates are part of the 'Life underwriting & pricing' risk class.
- **Financial impact**: The Solvency II coverage ratio decreases by 24ppt due to the scenario.
- **Application**: 'Strategic Risk Assessment' as current use and 'ORSA' as a future use.
- **Risk drivers**: Strategic risk drivers in scope are 'New business volumes' and 'New business margin.' Market risk drivers used are 'Expense inflation' and 'Benefit inflation.' Finally, lapse rates are selected as a driver in the 'Life underwriting & pricing' risk class.

3.5 APPLYING MANAGEMENT ACTIONS

To keep the scenario inventory somewhat concise, management actions are treated the same as scenarios in the framework. This can be done as, in practice, management actions are an extension of an existing scenario calculation. In a way, a management action is therefore just another scenario. The characteristics listed in the previous section can therefore also be defined for the management action.

When including a management action in the framework, it should be described in such a way that:

- It is clear to the user what the action is.
- There is a clear reference to the scenario onto which the action is applied.
- The qualitative description is such that it describes action and its foreseen impact in sufficient detail.

In this way, it should hold that assessing the scenario and management action together in the scenario inventory provides users with enough information for the action to be re-used in other scenario calculations.

3.6 EXAMPLE: ADDING A MANAGEMENT ACTION TO THE SCENARIO INVENTORY

To show how a management action can be included in the framework, we again look at the inflation scenario of Section 3.4. The (re)insurer decides to de-risk its asset portfolio to improve its financial position. The qualitative description of this management action is as follows:

'To further strengthen its solvency position, the asset portfolio of the insurer is being derisked. This is done by selling half of its equity position and reinvesting the proceedings into government bonds.'

The management action is now added as follows in the inventory:

- **Scenario name**: Management action – Scenario #ID Persistent inflation risk.
- **Scenario description**: Equity investments are decreased by 50%. This is reinvested in government bonds. This management action leads to a decrease in equity level and volatility risk, an increase in spread risk and a decrease in long-term asset returns.
- Complexity, application, time horizon, pace, severity: set equal to the main scenario.
- **Time stamp**: 02/08/2024 (the calculation date).
- **Risk classes**: Set equal to the main scenario.
- **Financial impact**: The Solvency II coverage ratio now only decreases by 9ppt after management action.
- **Application**: 'Strategic Risk Assessment' as current use and 'ORSA' as a future use.
- **Risk drivers**: The risk drivers from the scenario plus the changes in risk drivers that are related to the management action. In this case, this would be the change in asset allocation.

By including both the drivers of the scenario before and after management action, the framework allows for the use of the management action as a standalone scenario. The impact of the management action on the scenario can still be determined on basis of the scenario inventory. For this, the financial impacts of the scenario before and after management action need to be compared (e.g., -24ppt versus -9ppt, respectively).

3.7 COMPLETENESS AND CONSISTENCY CHECKS

Having ready access to an overview of all stresses/scenarios and their characteristics can aid the re-use of suitable scenario storylines, assumptions, parameter calibrations and results, without having to start from scratch each time. It also provides insight into the various uses scenarios can have, further promoting the re-use of scenarios and their results.

To add value in terms of scenarios being up to date, complete and consistent with the risk appetite, the framework tries to connect the risk inventory with the scenario inventory. This is done in two ways:

Coverage check:

Ideally, it should be the case that all key risk exposures are sufficiently covered by SST, as this allows management to gain proper insight into the company's current and forward-looking risk profile.

The framework achieves this by mapping the scenarios in the scenario inventory to the key risk exposures in the risk inventory. This provides insight into how many times each key risk exposure is included in the stress/scenario set. It is up to the user of the framework to then assess whether a key risk exposure is sufficiently covered by the current SST.

In the example inventory this coverage check is included in the risk inventory. Minimum requirements are defined on the basis of the current risk classification (e.g., 'High,' 'Medium' or 'Low') and the risk category (e.g., 'Univariate,' 'Multivariate' or 'Grouped'). The minimum requirements applied are as follows (and again, these are purely illustrative, and it is up to the user of the framework to specify requirements that are appropriate for their organisation):

- **Univariate**: These key risk exposures are typically quantified using their own unique risk drivers. To assess whether the exposures are appropriately covered, the corresponding risk drivers in the scenario inventory are used. The coverage check in the example inventory requires 'High' classified risks to be included in at least four multivariate scenarios and at least four univariate scenarios. For 'Medium' classified risks, these limits are set to three and three, respectively. For 'Low' classified risks, it is required that they are included in at least one univariate scenario.

- **Multivariate**: Due to their specific and multivariate nature, it is sufficient for these exposures to be included at least once or twice in scenario calculations. An example would be ‘Geopolitical risk.’ Testing the impact of such an event once or twice should be sufficient for stakeholders to appropriately understand the (re)insurer’s current and future exposure to this risk.
- **Grouped**: For this category the same reasoning holds as for ‘Multivariate’ risks. It is sufficient that each group is included at least once or twice in the stress and scenario calculations. An example is a business operating event. Although the underlying risks triggering these events can be very different, the way in which the impacts are quantified in scenario calculations is usually similar. Performing many stress and scenario calculations on these groups, therefore, does not lead to a substantial increase in stakeholder understanding of the risk profile.

The coverage check also works the other way around. In case new scenarios are defined by stakeholders, including them in the scenario inventory (as explained in Section 3.4) requires the qualitative description to be mapped to the risk classes defined in the risk inventory. This might lead to the identification of risk exposures that are not yet part of the existing risk universe (and hence need to be added).

Consistency check:

When the (re)insurer’s risk profile or appetite does not change materially, (parts of) scenario calculations can potentially be re-used in successive SST exercises. To support this, the framework includes a check to see whether previous calculations are still in line with the current risk view. This is achieved by combining:

- **Risk classification**: comparing the current and previous risk classifications in the risk inventory, to see whether the risk profile changed
- **Time stamp**: the valuation date of the scenario calculation, included in the scenario inventory
- **Risk drivers and classes**: the risk drivers in scope of the calculation as specified in the scenario inventory, and their corresponding risk classes in the risk inventory

Based on these, the check now verifies whether the risk classification of a risk class corresponding to a risk driver materially changed after the date the risk driver was last calibrated.

This consistency check is included in the scenario inventory. For each risk driver in scope of a scenario calculation, it indicates whether or not it is still fit-for-use in new calculations:

- **Green**: There is no material change in risk profile.
- **Amber**: The risk classification went from either ‘High’ to ‘Medium’ or ‘Medium’ to ‘Low.’
- **Red**: All other cases.

The checks support the user in deciding which parts of the scenario can be re-used. It also provides insight into whether or not calculation results are still appropriate, given the current risk profile. A material change in risk profile results in many of the consistency checks turning red, implying that the (re)insurer needs to reperform several of its stress/scenario tests.

4 Applying the scenario testing framework

The framework encourages the re-use of available storylines, assumptions, parameters and results, using two distinct applications:

- **Top-down**: A new scenario is defined by management, after which the scenario inventory is used to see which (parts of) previous calculations can be re-used for this new scenario.
- **Bottom-up**: When undertaking a given SST exercise, instead of defining stresses/scenarios from scratch, first consult the existing scenario inventory and select any suitable stresses/scenarios which may be used as a starting point. After this initial selection, the final scenarios are based on these existing ones and/or added on top of these.

In the following sections, a step-by-step guide is included on how to apply these two approaches.

4.1 TOP-DOWN APPROACH

When applying the top-down approach, a new high-level scenario description is available. Before fully specifying the scenario, organising scenario workshops, defining parameters with subject matter experts and performing the calculations, the framework prescribes that the following steps are first undertaken.

FIGURE 6: TOP-DOWN APPROACH TO DEFINING SCENARIOS

STEP	DESCRIPTION
[1]	**Defining the purpose of the scenario**: The purpose of the scenario is defined in line with Section 2. Defining the objectives is key, as it implicitly determines the main characteristics that apply to the scenario and are included in the scenario inventory.
[2]	**Complexity, time horizon, pace and severity**: Once the purpose of the scenario is known, further scenario characteristics are identified by setting the corresponding complexity, time horizon, pace and severity.
[3]	**Risk classes**: The risk classes in scope are identified. Does the scenario for instance include a market stress, liquidity stress or a business operating stress?
[4]	**Check against existing inventory**: By filtering scenarios in the inventory based on the characteristics and risk classes identified, the user can now decide whether previous scenario calculations can potentially be re-used. If this is indeed the case, Steps [5] to [7] can be skipped.
[5]	**Qualitative description**: This step is followed if previous scenarios cannot or should not be re-used. A new qualitative description of the scenario needs to be drafted. The qualitative description describes how the scenario unfolds, which key risk exposures are in scope and how these develop over time.
[6]	**Quantitative description**: The qualitative scenario description is translated into an overview of which risk drivers are used in the calculations and are therefore in scope of the scenario.
[7]	**Application**: Here, the choice should also be made as to whether or not it is sufficient to apply the stress in a point-of-time manner or if the stress should be applied throughout the scenario.
[8]	**Risk drivers**: Once all main scenario characteristics are known—either by defining them from scratch (Steps [5] to [7]) or by re-using previously defined stresses/scenarios, the parameters corresponding to the risk drivers can now be set, consistent with these characteristics. Note that—even when reusing scenarios—it is likely that the parameters need to be reassessed and, if needed, updated to reflect the scenario in scope and/or current risk profile.
[9]	**Scenario calculations**: The results of Steps [1] to [8] are combined, and the stress/scenario is finalised and ready for the calculation phase. Please note that the choice of valuation methodology is made as part of this step and is dependent on the outcome of Step [7].
[10]	**Update the inventory**: The inventory can now be updated to reflect the new scenario calculations. In case a scenario is re-used, the time stamp and parameters of this calculation can be updated. In case the scenario is new, it should be added to the inventory in line with Section 3.4. In this case, the 'Applications' sections should be updated as well. Finally, in case a 'Governance' and/or 'Scenario categories' section is also included in the scenario inventory, these will also require an update.

In Section 5, several use cases are included where these steps are applied onto scenario calculations and the inventory in the example inventory.

4.2 BOTTOM-UP APPROACH

Instead of defining scenarios from scratch, first, scenarios are selected that can be used as a starting point.

The framework provides two ways for the selection of previous scenarios that can potentially be re-used:

- **Applications**: If the purpose of the SST exercise in question (e.g., ORSA, recovery plan, etc.) is already included in the 'Applications' section of the scenario inventory, it is simply a matter of filtering this section and using the resulting selected scenarios as a basis.
- **Characteristics**: A second method is to filter on the basis of some of the general scenario characteristics such as 'Complexity,' 'Time horizon' and 'Severity,' much in line with Steps [1] and [2] of the top-down approach in the previous section. This can also result in a selection of scenarios that are fit for purpose.

After this initial selection, the final scenarios are based on these existing ones and/or added on top of these.

5 The framework in practice – sample use cases

This section includes various use cases showcasing how the scenario framework can be of added value. These use cases all make use of the example in the example inventory.

5.1 USE CASE I: RE-USING A SINGLE-SCENARIO CALCULATION

In this example, a new scenario is calculated on basis of a single scenario that is already available in the scenario inventory. This situation may arise for a number of reasons, including:

- The new scenario is an update of an existing one. This may be the case if the (re)insurer decides to include a scenario in the ORSA multiple years in a row, which does not have to be considered from a different angle.
- The new scenario is the same as an existing one but used for a different purpose. An example is when the (re)insurer decides to re-use an ORSA scenario in its pre-emptive recovery plan.
- The new scenario is very similar to an already existing one. This can be the case when a supervisor for instance requires an ad-hoc calculation of a scenario which is already available in the inventory. In 2024 EIOPA requested insurers to perform a geopolitical stress test.[12] As geopolitical risk at this stage was already seen as a mature risk exposure, it is likely that many (re)insurers already had such a scenario in their inventory.

We continue with the example (mentioned previously) of where an existing scenario is used for a different purpose.

The (re)insurer needs to perform its periodical SRA. As part of this, the (re)insurer wants to assess the long-term resilience of its business plan in case expense and claims levels remain at too high a level. Such a scenario already exists in the scenario inventory, as a similar scenario was included in the previous year's ORSA. The qualitative description of this 'sustainable cost levels' scenario is as follows:

'In this scenario, expense and claims levels remain at too high a level for both the in-force book (not managing cost in line with runoff of the books) and new products. This leads to a higher new business strain and, on the longer run, lower new business volumes as the company is not able to successfully compete with its direct competitors.'

Applying the scenario testing framework on this stress now could look as follows.

12. The results of EIOPA's 2024 insurance stress test are available at https://www.eiopa.europa.eu/insurance-stress-test-2024_en.

FIGURE 7: USE CASE I – RE-USING A SINGLE-SCENARIO CALCULATION

STEP	DESCRIPTION
[1]	**Defining the purpose of the scenario**: The objective of this scenario is to assess the (re)insurer's resilience in case of persistent high claims and expenses over a long period of time.
[2]	**Complexity, time horizon, pace and severity**: Multiple risk exposures are in scope of the scenario as both claims and expenses are in scope. The time horizon is set to 'exploratory' due to the long-term nature of the SRA. The severity is set to 'Target range' as the purpose is to test the long-term resilience of the (re)insurer's business model. Finally, the pace best suited to the scenario is 'Fast-moving' as the high level of claims and expenses occur instantaneous and remain at a high level throughout the scenario.
[3]	**Risk classes**: 'Strategic – External,' 'Life underwriting & pricing,' and 'Non-Life underwriting & pricing' are the classes in scope of the scenario. The first class represents lower new business volumes/margins and an increase in the fixed expense base of the (re)insurer, whereas the last two represent an increase in claims and variable expenses.
[4]	**Check against existing inventory**: A scenario with the same characteristics as defined in Steps [1] to [3] is already present in the scenario inventory, namely the 'sustainable cost levels' scenario.
[5] to [7]	The 'sustainable cost levels' scenario can be re-used for the purposes of the SRA. Hence, these steps can be skipped.
[8]	**Risk drivers**: The risk drivers used in the 'sustainable cost levels' scenario are as follows: ▪ New business volumes: decreasing by 10% in the first two projection years, 15% in the third projection year and 20% thereafter ▪ New business margins: decreasing by 25% across the whole projection horizon ▪ Fixed expense basis: increasing by 10% across the whole projection horizon ▪ Variable expenses: increasing by 5% across the whole projection horizon The risk profile in scope of these drivers did not materially change since the ORSA calculations were performed. As such, there is no direct need to update these to better reflect the (re)insurer's risk profile. The main change the (re)insurer could consider is to further differentiate between short-/medium-term and long-term impacts on the risk drivers.
[9]	**Scenario calculations**: The results of Steps [1] to [8] are combined. Due to the similarities between the ORSA-scenario and the new SRA-scenario, the methodology can be re-used. The valuation date and financial position of the (re)insurer are updated and the projection period is set such that the scenario appropriately reflects the scenario being of 'exploratory' nature.
[10]	**Update the inventory**: The inventory can now be updated to reflect the new scenario calculation. Because changes were made to (1) the projection horizon and (2) the valuation date is more recent than the ORSA-scenario, the choice is made to add the SRA-scenario as a new scenario, next to the ORSA one.

5.2 USE CASE II: COMBINING SCENARIOS

In this example, the (re)insurer wants to analyse an emerging risk scenario characterised by demographic and social changes. The scenario is based on the 'Young at heart in an ageing world' scenario in the 2025 Generali Emerging and Sustainability Risks Booklet[8] that has the following qualitative description:

'In this scenario, the insurer's primary challenge lies in effectively addressing the evolving and diverse needs of the population. This includes offering tailored solutions for vulnerable and underserved groups, such as migrants and older adults requiring specific healthcare and pension products, as well as for younger customers, who increasingly seek digital and sustainability-oriented insurance offerings.'

Before calculating the scenario from scratch, the scenario testing framework is applied using this qualitative description as a starting point. The application of the steps from Section 4 could look as follows.

FIGURE 8: USE CASE II – COMBINING SCENARIOS

STEP	DESCRIPTION
[1]	**Defining the purpose of the scenario**: The objective of the scenario is to explore the long-term impact of the evolving and diverse needs of an ageing population. The key risk exposures linked to the scenario do not occur instantaneously but gradually mature over time. The main purpose of the scenario is to test the resilience of the insurer's long-term strategy in a changing environment and to provide insight into how they can better prepare for such a scenario.
[2]	**Complexity, time horizon, pace and severity**: The complexity of the scenario is set to 'Multivariate' as multiple key risk exposures are in scope. The time horizon is set to 'exploratory,' since it requires assessing the insurer's financial position beyond the strategic business planning period. The purpose of the scenario is to test the resilience of the insurer's strategy in a changed environment; setting the severity equal to 'Target range' is the most appropriate here. Finally, this is a 'Slow-moving' scenario, as the scenario culminates gradually over time.
[3]	**Risk classes**: Several risk classes are identified using the qualitative description: ▪ Strategic – internal: the risk of the insurer not being able to change its product offerings to tailor to the needs of its changed customer base ▪ Strategic – external: the risk of the decline of relevant geographies' earnings growth in the mid-term due to negative demographic trends ▪ Underwriting & pricing – Life: increased longevity risk and higher health care costs
[4]	**Check against existing inventory**: When filtering the scenario inventory based on the characteristics defined previously, it follows that there is one scenario with similar characteristics, namely 'AI and Digitalisation.' Although the complexity, time horizon and severity match the ones of the new emerging risk scenario, the one-off operational costs and increased lapse rates driving the 'AI and Digitalisation' scenario make it quite different from the new scenario. Fortunately, there are also two other exploratory scenarios which—when combined—match the characteristics of the new scenario quite well: ▪ Longevity risk: Exploring the impact of assumptions about life expectancy and mortality rates being set inaccurately due to advances in medical research or improving health conditions. ▪ Being outrun by competition: In this scenario, the company is not meeting changing customers' expectations and is unable to transform the business with respect to market trends (including, among other things, AI, customer expectations and changing markets). This leads to lower new business volumes across the board and an increased expense base. When combining the 'Longevity risk' and 'Being outrun by competition' scenarios, the only key risk exposure not covered is the increase in health costs due to rising demand from an ageing population. This should be added when parameterising the scenario in Step [8].
[5] to [7]	The 'Longevity risk' and 'Being outrun by competition' scenarios can be re-used. Hence, these steps can be skipped.
[8]	**Risk drivers**: as a first step, the risk drivers of the 'Longevity' and 'Being outrun by competition' scenarios are combined. Next, we check whether all key risk exposures identified in Step [3] are appropriately captured. The 'Being outrun by competition' scenario already has a parameter representing an increased fixed cost base, but we feel that this does not yet fully capture the 'increased health cost' element of the new scenario. As a result, we decide to also stress variable expenses. Finally, we check whether the parameters used to stress the risk drivers are appropriate, given the scenario. As both the 'Being outrun by competition' and 'Longevity risk' scenarios are similar in nature to this new scenario, we decide to keep them unchanged.
[9]	**Scenario calculations**: Of the two scenarios forming the basis of this new scenario, the 'Being outrun by competition' scenario is the most intricate one, as it involves changes in new business volumes, margins and the fixed expense base. Instead of calculating the new scenario from scratch, we decide to calculate the scenario as follows: ▪ The 'Being outrun by competition' calculations are used as a basis, meaning that we use the same calculation setup and methodology as was used here. ▪ To reflect the correct valuation date and projection horizon, the inputs related to the insurer's financial position (e.g., balance sheet and P&L) are updated to match the new scenario's requirements. ▪ Next, the longevity stress and variable expense stress are added, such that all key risk exposures are included. ▪ Everything is now in place for the new scenario to be calculated. Results can be produced, analysed and shared with stakeholders.
[10]	**Update the inventory**: The scenario inventory can now be updated to reflect the new scenario calculations. This also includes the 'Applications' section. Regarding the latter, the main purpose of this scenario is to explore the long-term resilience of the strategy. However, the scenario might also be used in reports such as the ORSA or capital management plan.

In this example, two scenarios are combined that are already in the scenario inventory, including their impact on the financial position of the (re)insurer. Having this information can be useful for validation the results, as it is reasonable to assume that the two individual impacts give a ballpark indication as to what the impact should be when combining them. This shows that the scenario testing framework can also be used as a validation tool for SST.

5.3 USE CASE III: DRAFTING A NEW REPORT

In this example, the insurer needs to start drafting a new risk report that requires the inclusion of SST. The scenario testing framework is used to see what calculations are already available for potential re-use in the report. This leads to a first selection of scenarios that can be used as input when organising a scenario workshop to make the final scenario selection.

The framework provides two ways to get an overview of which previous scenarios can potentially be re-used:

- **Applications**: The user can filter on the details included in the 'Applications' section of the scenario inventory. If the report is already included in the 'Applications,' it is simply a matter of filtering on this report and using the resulting selected scenarios. In case the report is not available, reports that are similar to the report that should be drafted can be selected to arrive at a subset of scenarios potentially fit-for-use.
- **Characteristics**: A second method is to filter on the basis of some of the general scenario characteristics such as 'Complexity,' 'Time horizon' and 'Severity,' much in line with Steps [1] and [2] of the step-by-step approach included in Section 4. This can also result in a selection of scenarios that are fit for the purpose.

5.4 USE CASE IV: CHECKING COMPLETENESS OF THE SCENARIO CALCULATIONS

Given the example in the example inventory, the completeness check is performed in line with Section 3.7. As was mentioned already, the check included is purely illustrative, and it is fully up to the user of the framework to specify requirements that are appropriate for their organisation.

Recall that the completeness check included in the risk inventory combines the key risk exposures identified with the number of times they are included in the SST performed. The minimum coverage requirements set in Section 3.7 are different, dependent on the complexity of the key risk exposure.

Applying the minimum requirements in Section 3.7 onto the risk and scenario inventories in the example inventory now leads to the following assessment:

- **Multivariate**: consist of the strategic risk exposures in the insurer's risk appetite. First an assessment is made how many times a strategic risk exposure is in scope of a scenario. This is done by filtering the scenario inventory on basis of the risk classes 'Strategic – Internal' and 'Strategic – External.' It can be the case that a strategic key risk exposure is included in multiple scenarios. This is for instance the case with 'Legal & Regulatory developments.' In the scenario inventory of the example inventory, this event is included in both the 'Regulatory environment' and 'Climate change – transition risk for assets' scenarios. All strategic risk exposures except 'Geopolitical risk' are captured by at least two scenarios. For 'Geopolitical risk' a scenario is included that specifically focuses on this exposure. Adding bespoke geopolitical scenarios will likely not add much additional insight into stakeholders' understanding of this risk exposure. As such, we expect that the scenario calculations performed sufficiently cover the insurer's risk profile.
- **Grouped**: For this category it follows that only 'Business continuity risk' is not covered by the stress and scenarios in the scenario inventory. Business continuity scenarios should either be included in the inventory based on available results or should still be analysed to provide additional insight into the insurer's risk profile. For the grouped risk exposures that are included in the scenario inventory, it follows that none of them are tested through dedicated, univariate stress tests. They are only tested as part of wider ranging scenarios. For the 'Operational risk' category, the assessment is made that this is not sufficient and univariate stress testing is required.
- **Univariate**: There are several key risk exposures that are marked as 'not sufficiently covered' in the risk inventory. In most cases this is due to exposures not being sufficiently covered in the univariate stress testing. It is up to the user to decide whether additional scenarios and/or stresses are required. For 'concentration risk' it for instance holds that this exposure is not covered in any stress and scenario tests. Due to its 'Low' materiality though, one could decide that this is acceptable.

5.5 USE CASE V: IDENTIFYING NEW RISK EXPOSURES

As mentioned in Section 3.7, the coverage check also works the other way around. In case new scenarios are defined by relevant stakeholders, including it in the scenario inventory requires that the qualitative description is mapped to the risk classes defined in the risk inventory. This might lead to the identification of risk exposures that

are not yet part of the existing risk universe but should be part of it. In this example, we show this by considering the 'Data Privacy and Data Ethics' scenario as identified by the CRO Forum's Emerging Risks Initiative[13]:

'The regulatory frameworks surrounding data ethics and privacy (e.g., GDPR, AI Act, DSA) are imposing stricter controls on data collection, processing, and usage, while public awareness of digital rights, surveillance, and algorithmic bias continues to grow. Insurers are under pressure to balance data-driven business models with ethical and regulatory expectations, amidst increasing scrutiny over fairness, transparency, and obtaining informed consent. As data privacy regulations empower individuals with greater control over their personal information, insurers face potential restrictions on accessing critical data used for risk assessment, underwriting, claims management, and fraud detection. Missteps in data usage may expose insurers to reputational damage, litigation, and regulatory sanctions. These challenges are especially acute in the context of AI-driven decisions, health data processing, and behavioural profiling.'

The impacts of this scenario mainly focus on the following:

- Restrictions on the use of certain data types—such as genetic, health or behavioural data—could limit product innovation and personalisation across both Life and Health and Non-life lines.
- Regulatory limits on data use in pricing models may erode risk-based pricing, threatening the principle of actuarial fairness and reduced affordability for higher-risk groups.
- Limited access to predictive data increases the risk of adverse selection. Actuarial models may become less reliable, leading to premium volatility, reserve uncertainty and reduced capital efficiency.
- A rise in litigation over data misuse, especially under collective redress frameworks, may increase claims and compliance costs. High-profile cases could damage trust in insurers' handling of sensitive data.
- Navigating overlapping regulatory regimes creates compliance complexity and cost. Ensuring compliance across jurisdictions demands significant investment in data governance, staff training and legal expertise. It may also delay or deter adoption of advanced analytics, AI or connected devices due to legal uncertainty.

Although there is overlap with key risk exposures such as 'Business strategy risk' and 'Legal & Regulatory developments,' the insurer could conclude that the 'Data Privacy and Data Ethics' is not sufficiently captured by its current key risk exposures identified and that it should be included as a separate key risk exposure in the risk inventory.

5.6 USE CASE VI: CHECKING CONSISTENCY WITH THE RISK PROFILE

The proposed scenario testing framework also includes a consistency check, as described in detail in Section 3.7. In the example inventory, the consistency check is included in the risk driver section of the scenario inventory. For each risk driver, a mapping is made to the key risk exposures in the risk inventory. When the insurer's risk profile has changed materially, since the last calculation date of the stress or scenario, the check indicates whether or not the parameterisation of the risk driver is still fit-for-use.

In the sample risk inventory that is included in the example inventory, note that, for all key risk exposures, the current risk classifications are set equal to the previous ones. To see how the consistency check can be applied in practice, the following changes are made to the risk classifications in the risk inventory:

- **Spread widening risk**: 'Medium' in the previous cycle to 'High' in the current one
- **Life lapse risk**: 'High' in the previous cycle and 'Medium' in the current one

It now follows that for all stress and scenario calculations that include a spread widening stress, the consistency checks are set to 'Red.' For all cases that include a lapse stress as part of their life underwriting & pricing risk, the consistency checks are set to 'Amber.'

Having such an overview for all drivers to hand can support the user in determining the extent to which a previous stress or scenario calculation can be re-used.

13. CRO Forum. (2025). Emerging Risks Initiative: Major Trends and Emerging Risk Radar. Retrieved 13 November 2025 from https://thecroforum.org/wp-content/uploads/2025/07/ERI-Risk-Radar_2025.pdf.

6 Conclusion

Stresses and scenarios for different purposes are often considered in isolation, rather than in a coordinated way, and sometimes without guidance on approach. Using the scenario testing framework as described in Section 3 can have several benefits, as is shown throughout this paper:

- **Efficiency**: The framework provides insight on the various uses a scenario can have, promoting re-using scenario results for different purposes where possible, be it newly defined scenarios or new risk reports.
- **Completeness**: By cross-checking the risk inventory and scenario inventory, insight is provided into which key risk exposures are appropriately covered. Cross-validating scenario descriptions with the risk inventory also serves as an additional check to see if this risk inventory is complete. This might lead to the identification of risk exposures that are not yet part of the existing risk universe but which should be part of it.
- **Consistency**: Maintaining an inventory of stress and scenario calculations allows the (re)insurer to have an overview of whether the calculations are still sufficiently up to date and in line with the current risk profile.
- **Integration**: Making the scenario inventory an integrated part of the risk management framework leads to further integration of scenario calculations in risk management.

Setting up the framework for the first time requires some effort. Key risk exposures need to be selected from a more extensive risk register and mapped appropriately, such that there can be a sufficient link between the risk register and scenario register. The scenario inventory includes the relevant stress and scenario calculations performed over the current and previous risk management cycles, each of which is broken down into its relevant characteristics and risk drivers and mapped back to the risk register.
Finally, the completeness and consistency checks need to be put in place, using the (re)insurer's expert judgement.

Once completed, however, updating and using the framework should require little effort, whilst providing the benefits as outlined previously. SST is already commonplace within the risk management framework. Companies now require stresses and scenarios to be modelled for a variety of purposes, such as SCR-calculations, the ORSA, pre-emptive recovery planning, risk appetite and business planning. Having a scenario testing framework integrated into the risk management framework can be of great added value. With maturing risk management frameworks and regulatory efforts often leading to additional SST requirements, the benefits of a good scenario testing framework are increased even further.

Example inventory

The examples and use cases of the scenario testing framework that are included throughout this paper are based on an example inventory. The example can be received upon request by contacting the authors of the paper. Their contact details are included below.

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