Extracting value from sales process management

Operational risk management case study

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ACKNOWLEDGEMENTS

Tools

The cognitive mapping analysis discussed within this research report was produced using DACORD Maps. More information about the software can be found here: http://www.dacord.co.uk/.

The Bayesian Network modelling performed for the case study was carried out using AgenaRisk Desktop. More information about the software can be found here: http://www.agenarisk.com/.

1 INTRODUCTION

1.1 Why is innovation in operational risk needed?

All companies pursue a set of strategic goals (or objectives) designed to satisfy the needs of their stakeholders. For insurers these goals will generally relate to:

- Remaining solvent so that they can honour commitments made to existing policyholders and continue writing new business.

- Earning a healthy profit to return to investors and members, or investing in new markets, products, or distribution channels.

- Carrying out their business in a responsible, fair, and law-abiding way.

Failure to meet these goals may be the result of adverse market or economic conditions or of deterioration in the demographic experience of insured lives. Generally, these risks are well understood and the risk management frameworks associated with them are correspondingly well developed. Yet success also relies on the many interconnected operational processes—and the controls associated with them—which lie at the centre of the day-to-day activities of an insurer. From staff development and retention to information technology (IT) systems, operational processes are an integral and unavoidable feature of running a business.

Identifying, monitoring, modelling, and managing the risks of the failings of these operational processes provides a wide range of challenges, which means there is no 'one size fits all' solution. Even when all of the processes are followed correctly, unexpected outcomes can still occur.

In fact, operational risk is frequently less well understood in a typical company's enterprise risk management (ERM) process. It is not just a case of sparse, heterogeneous data which makes understanding operational risks difficult. The interaction between operational processes and the dependence on both internal and external factors means that a holistic, dynamic approach to risk management is needed. All too often, operational risks are thought of as buildings falling, computers crashing, or compliance breaches, but the ultimate purpose of a business's existence is to operate all activities to achieve business targets. Rather than asking what parts of the business might fail, it is better to ask what might stop the company from achieving its goals. This slightly different way of questioning is significant and, in fact, mind-opening. In this research, we present a case study where we ask 'what might stop you from achieving your annual sales budget?' This way of questioning opens up the universe of factors, not just IT breakdowns, that affect business goals.

Despite the growing recognition of operational risk as a major source of uncertainty for insurers, modelling operational risk continues to rely on either simple linear scaling formulas or data-dependent statistical methods. These techniques may provide a useful, high-level indication of the size of a business's overall operational risk exposure, and for some specific operational risks (particularly those characterised by low-severity, high-frequency events), statistical techniques could deliver an accurate basis for analysis.

However, in order to facilitate enhanced decision-making the chosen modelling technique also needs to be capable of assessing non-financial factors such as lower new business volumes, reduced persistency, or reputational damage. And to be truly powerful, operational risk models need explanatory as well as predictive power, to enable firms to identify and understand the sources and pathways of operational failure.

1.2 Background to the research

In February 2013, Milliman published a comprehensive research report on operational risk, 'Operational Risk Modelling Framework.'[1] The report explored the nature of operational risk events and explained why operational risk was too important for organisations to ignore. The report reviewed the most common approaches to quantifying operational risk (primarily from a capital perspective) and introduced a structural approach as a mechanism for not only describing operational risk outcomes but also understanding the causes.

Adopting a structural (or causal) approach[2] to operational risk assessment carries a wide range of benefits, not only in terms of determining a more meaningful capital number but also by allowing for more effective risk management. Such approaches encourage the development of holistic risk frameworks, which begin with establishing an understanding of the complete operational risk profile of a firm and extend to scenario testing and resilience planning.

1   J. Corrigan, & P. Luraschi. (February 2013). Operational Risk Modelling Framework. Milliman Research Report. Retrieved December 23, 2015, from http://us.milliman.com/uploadedFiles/insight/life-published/operational-risk-modelling-framework.pdf.
2   J. Corrigan, N. Cantle, & F. Vosvenieks. (June 7, 2013). Measuring operational risk capital to deliver business value. Milliman Business of Risk blog. Retrieved December 23, 2015, from http://thebusinessofrisk.com/?p=1040.

Causal approaches have their roots in the study of complex systems (or 'complexity science'). Milliman's application of the approach to operational risk begins with viewing a company as an open system of outcomes, patterns, processes, and relationships, including those which impact it from outside. Building a successful causal model requires two elements: a deep understanding of the critical dynamics that are to be modelled; and a way to faithfully reproduce those dynamics in a manner that remains useful for the business. To achieve the former, we use cognitive mapping to develop a holistic view of a firm's operational risk profile. For the latter, we build a causal model for operational losses using a Bayesian network, which reflects the drivers of uncertainty. The resulting framework is capable of capturing the dynamic links between causes and losses, which enables risks to be viewed in context and avoids incorrect conclusions which arise from silo-thinking.

In Europe, and other mature markets, causal techniques are beginning to gain traction. This is driven partly by the continued use of existing formula-driven quantification methods, which offer no capital benefit for improved operational risk management, and partly by firms seeking to evolve their current practices to provide enhanced explanation and monitoring. In Asia, where approaches to operational risk are typically less developed and risk assessment is commonly only qualitative in nature, firms have an opportunity to bypass the issues of more traditional quantification methods and implement causal techniques today.

In this research report, we demonstrate the application of causal techniques with reference to a case study firm in the Asian insurance market. We follow a proven 'best practice' process, which has three main components:

1. Description of the operational risk profile

2. Scenario identification

3. Scenario quantification and analysis

If implemented carefully, the techniques used facilitate the development of a robust, tractable, and credible modelling framework. We have therefore chosen to highlight particular areas where input, challenge, and sign-off from the business, paired with thorough validation, are essential to a successful implementation. We have also sought to identify the challenges which are particular to working within a less mature risk management framework, for example less developed monitoring or reporting processes.

Some of the benefits of causal techniques particularly applicable (but not exclusive) to Asian insurers are summarised below.

▪ Causal models provide a mechanism for robustly incorporating expert judgement into the quantification of operational risk, reducing the need for a rich loss database. As the credibility of loss data improves this can be gradually incorporated into the model calibration.

▪ Some Asian insurance markets are not yet at a level of maturity comparable with other more established markets such as North America or Europe. Product designs, distribution channels, business practices, and the regulatory environment all continue to evolve. Where experts are able to make reliable, short-term forecasts into how these changes will affect their companies, they can be incorporated directly into causal models to allow operational risk losses to be projected into the future.

▪ Furthermore, the impact of planned or anticipated management actions in response to these changes can be evaluated in a causal model framework to assess their effectiveness and identify any unexpected consequences.

▪ Traditional statistics-based models, such as the Loss Distribution Approach, are less well established within the Asian markets. These techniques essentially derive the ultimate loss distribution in one step, whereas causal models allow the loss estimate to be built up in a way which reflects the pathways that lead to operational failures.

▪ Where monitoring frameworks, including key performance indicators (KPIs), are still in development, the approach used to elicit the underlying causal model structure also identifies the processes and items that should be monitored in order to assess operational risk levels.

This final observation is a specific example of a more general point that the development process (as illustrated in this report) delivers much more than just an enhanced methodology for quantifying operational risk. If adopted fully, the approach can be used to implement a comprehensive risk management framework which covers risk identification, monitoring, reporting, and forecasting.

To complement the case study application, we also carried out an extensive market survey of operational risk practices found in Asian insurance companies. Participant companies came from nine different countries and their responses provided insight into a wide variety of risk areas including monitoring, modelling, training, and discussion. The results of the survey are presented in Section 2 of this report. Not only do these results provide a useful context for our case study but they also highlight the mismatch between the potential significance of operational failures and the (typically low) priority attributed to operational thinking in a business.

1.3 Case study

To test the potential for implementing Milliman's approach based on complexity science in markets with less well developed risk management frameworks (such as some Asian countries), we partnered with a major Taiwanese life insurance company[3] to carry out a case study covering one particular area of operational risk.

The current regulatory environment in Taiwan provides a useful indication of the overall level of maturity in Asia with respect to operational risk. Under current capital requirements, operational risk falls within category C4, 'Other Risks' where insurers are required to hold an additional capital margin in respect of any remaining risks not explicitly covered by the other components of the capital calculation. The margin is defined as the sum of between 0.5% and 1.5% of annual premium income and 0.25% of the assets under management. This is subject to an additional 'penalty' if recent claims experience is worse than the industry average. Like many similar methods applied in other markets, the approach is simple to calculate and understand and scales with the size of the business. However, it neither rewards firms that control their operational risk exposures nor penalises those businesses which take excess operational risks.

In response to global developments in risk management frameworks and the increasing importance attached to operational risk events witnessed in the financial industry, the Taiwanese insurance regulator[4] put in place the Practice Guidelines for the Risk Management of Insurers (known as the 'ERM guidelines'). These guidelines became effective in 2009 and were, in part, specifically introduced to address the approach to operational risk assessment under the current risk capital regime, which was considered to be inadequate.

The new ERM guidelines require that insurers identify, assess, and manage their operational risks through the use of historical operational failure data, risk and control self-assessments (RCSA), Key Risk Indicators (KRIs), or other tools. Use of these tools should go some way to helping companies better identify and monitor their operational risks through consideration of their unique business and risk profiles. However, the degree to which the guidelines provide for a consistent, coherent framework for understanding the drivers of operational uncertainty, assessing control effectiveness, and spotting emerging risks may still be limited.

Prior to the case study, our partner firm had an existing risk management framework in place. The key components of this framework were a methodology for quantifying operational risk, a recently implemented risk register, and a small loss event database. Relative to other firms in the region, the case study firm already compared favourably with respect to its operational risks framework.

During the case study period, the firm was undergoing a period of expansion in its home market and was particularly interested in techniques that would help it to manage the increased uncertainty associated with an evolving business model. Following a preliminary introduction to complexity-science-based approaches to risk management, the firm expressed a keen interest in understanding how they worked in practice and seeing how it would benefit first hand from any additional insight.

During further discussions with the company, our recommendation was that the case study (or proof of concept) focused on a specific area of operational risk. This would permit an initial framework to be developed to a sufficient depth in a manageable way, rather than attempting to cover every risk at a surface level, thereby limiting the insight that could be gained; or in full detail and implementing an entirely new, company-wide risk management framework in one go.

Given the increasing regulatory action and consumer awareness associated with mis-selling and inappropriate sales behaviour in different insurance markets globally, the firm elected to concentrate on sales risk and the operational processes upon which new business sales depend. This was an area that the firm was confident would generate strong engagement from the sides of the business directly responsible for sales as well as the operational departments which support new business acquisition.

The firm was also eager to trial an approach that would allow it to quantify not just the capital losses associated with operational failure, e.g., regulatory fines, compensation costs, increased training expenditure, etc., but also the impact such failures would have on the firm's ability to meet agreed targets for new business volumes.

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3   Referred to interchangeably as 'the company,' 'the firm,' and 'the partner firm.'
4   The Insurance Bureau (IB).

Following the summary of the market survey results in Section 2, the remainder of this research report covers the process we followed with our partner firm to develop a causal model for the operational risk associated with new business sales. The process has been broken down into the following major steps:

- *Risk discussion:* A comprehensive series of workshops and interviews were held with internal stakeholders of the company in relation to new business sales processes. Detailed in Section 4.

- *Risk profiling:* Cognitive mapping techniques were used to capture the narrative from the risk discussions to build up a complete operational risk profile and identify the key drivers of failure. Detailed in Section 5.

- *Scenario generation:* Candidate scenario outlines were produced based on the various sources and pathways of operational failure, using an analysed cognitive map. Detailed in Section 6.

- *Causal modelling:* The construction, calibration, and testing of a model for the outcomes associated with operational failure (or success) based on a Bayesian network framework. Detailed in Section 7.

- *Risk reporting:* The use of the finished model to provide improved business insight into the level and sources of uncertainty. Detailed in Section 8.

In Section 9, we conclude the report by summarising the benefits that the firm gained from employing this approach and look at the potential next steps that the firm could take.

2 MARKET SURVEY

2.1 Background
The theory associated with operational risk assessment has advanced significantly in recent years, but the methods that are used in practice still vary in complexity, both within industries and across countries. In October 2013, Milliman issued a survey on operational risk assessment to a large number of companies within the Asian insurance market. The survey consisted of around 50 questions covering a range of areas related to operational risk, namely:

- Risk management

- Modelling

- Data

- Use

The survey was distributed electronically and responses were received from 64 companies across nine different countries. The majority of respondents (36%) were based in India and were from either medium-sized (100 to 1,000 employees) or large (1,000 to 10,000 employees) companies (42% and 36% respectively).

FIGURE 1: RESPONDENTS BY COUNTRY AND COMPANY SIZE
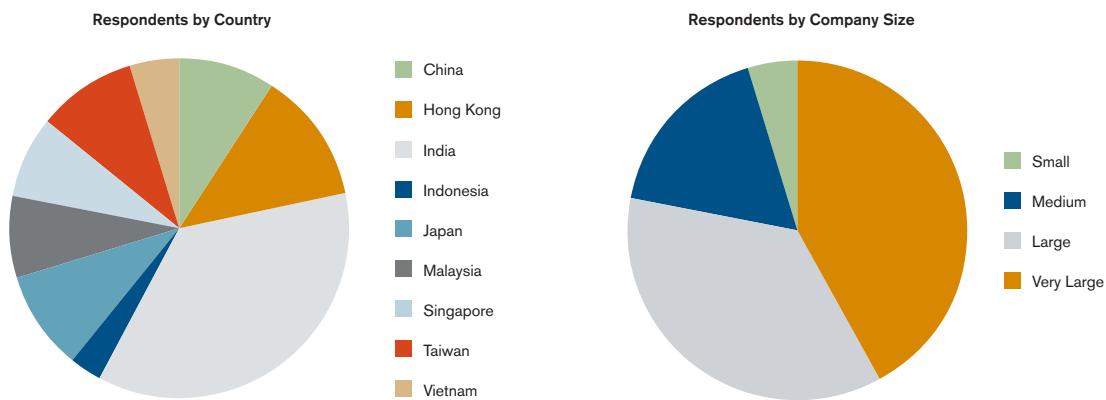
2.2 Risk management
Survey participants were asked to describe the priority given to operational risk issues within the risk management framework, with respect to:

- Frequency of operational risk discussions

- Department(s) and seniority of those parties involved in any discussions

- Level of maturity of the operational risk framework

- Topics that gain most attention in discussions at a senior level

- Tools used to identify operational risk exposures

The frequency with which operational risk issues are reviewed and discussed is a key driver of how successful the risk management framework will be. For those operational processes which are more likely to deteriorate gradually over time than fail suddenly, regular monitoring is essential to detect any build-up in risk. Whilst more frequent reviews should result in a more up-to-date view of key operational exposures, the on-going appropriateness of the monitoring framework (e.g., indicators, scenario tests, horizon scanning, etc.) should be kept under review to ensure it remains informative with respect to the current risk profile of the business. Care needs to be taken to ensure users of risk information remain engaged when using very frequent monitoring and reporting, which might suggest 'no change' for long periods of time.

The survey results indicated that most companies (70%) review their operational risk at the executive level on a quarterly basis, which we feel is in line with the industry practice within Europe. A further 16% reviewed their operational risks more frequently than quarterly. The survey also showed that a wide variety of people representing a large number of departments tend to be involved in the operational risk discussions, including:

- Audit
- Actuarial
- Information technology (IT)
- Underwriting
- Claims

Such widespread engagement within companies is encouraging, as it is rare that any single department or person within the business will have a complete understanding of a single operational risk, let alone the entire risk profile. Furthermore, engagement by the functional business areas not only ensures that operational risk assessments are meaningful and up-to-date but should also increase staff's awareness of the operational risks they are responsible for.

FIGURE 2: FREQUENCY OF OPERATIONAL RISK REVIEWS BY EXECUTIVE TEAM

- Never
- Infrequently
- Annually
- Quarterly
- Monthly
- Daily
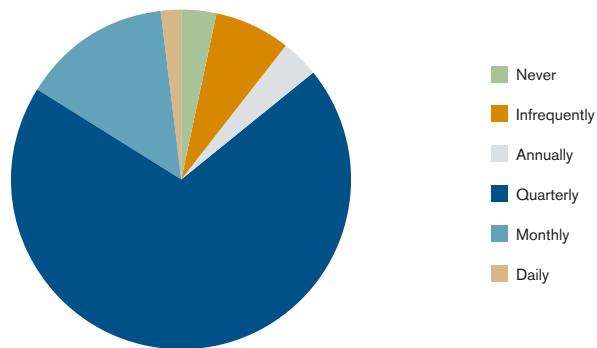
When asked about the maturity of their operational risk frameworks, survey participants were given a choice between the categories set out in the table in Figure 3.

FIGURE 3: MATURITY LEVELS OF OPERATIONAL RISK FRAMEWORKS

MATURITY LEVEL	CLASSIFICATION	DESCRIPTION
1	Ad hoc	Operational risk is only considered on an ad hoc basis using a non-standardised process.
2	Managed	Plans exist so that operational risk is considered at regular intervals using a non-standardised process.
3	Standardised	Plans exist so that operational risk is considered at regular intervals using a standardised process.
4	Semi-integrated	Operational risk is partially considered as part of all business processes (where applicable) using a standardised process.
5	Integrated and optimised	Operational risk is fully considered as part of all business processes (where applicable) using a streamlined process.

As illustrated by the chart in Figure 4, over 60% of the respondents rated their maturity levels as one of *Standardised* (41%), *Semi-integrated* (16%), or *Integrated and optimised* (7%).

- Ad hoc
- Managed
- Standardised
- Semi-integrated
- Integrated and optimised
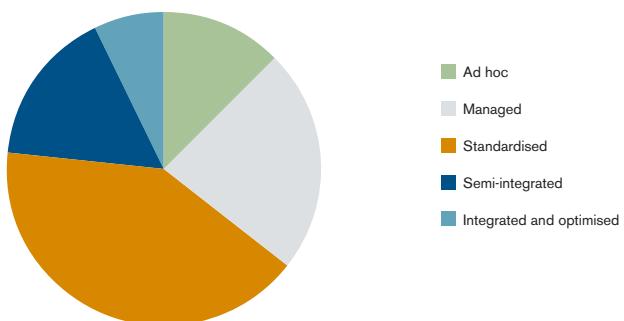
Such high levels of (at least) perceived maturity with respect to embedding operational risk considerations into business planning and processes indicates that operational risks are an important consideration for senior management.

In terms of the types of operational risks that are discussed, the most common included:

- Business conduct (e.g., mis-selling)
- Compliance
- Crime (e.g., fraud)
- External events (e.g., regulatory change, pandemic)

The survey indicated that the operational risk exposures discussed less often include:

- Infrastructure
- Loss of intellectual property
- Change management

With respect to the first two, the responses might reflect that these risks are considered very unlikely or are perceived to be well controlled. The dangers of dismissing or ignoring these types of exposures should be obvious; damage to a business's infrastructure or the loss of intellectual property could very quickly jeopardise the on-going viability of a company's business model. Equally, the change management process, especially in evolving insurance and financial markets like those found in Asia, is core to delivering strategic objectives related to new business or growth targets. More generally, it is important for firms to recognise that capital losses are not the only outcome associated with operational failure.

Based on the survey, the most common tools currently used to identify key operational risk exposures are risk registers and risk event logs. Risk registers now appear to be a permanent feature of risk management frameworks, whether in Asia or elsewhere. If implemented correctly, they can be a valuable tool for capturing key details about known risk exposures such as risk category, risk description, risk owner, etc., in a consolidated document. They may also contain high-level descriptions of the main risk drivers and the control environment.

However, even the best risk registers can encourage silo-thinking by attaching single characteristics or categories to each risk, and by failing to capture the dependencies that exist between risks. The likelihood and severity assessments commonly found in risk registers may also give a misleading view of losses by treating the impact associated with a particular event as a single event rather than a range of possible outcomes. Finally, when used in isolation, it is very difficult to spot emerging risks and to validate risk registers to ensure they have complete coverage of the current operational risk profile.

Where risk events are high-frequency, low-severity, risk event logging can help to parameterise loss distributions. And all risk events, however sparse, can be used to validate the outputs of any approach used to assess operational losses. However, for most risks there will be very limited historical data available, and given the nature of operational risk events the causes of these losses are unlikely to be stable over time. As with risk registers, past risk events are unlikely to provide much insight into new or emerging risks.

Risk workshops were the next most popular approach, with around a third of respondents disclosing that they were used within their firms. The use of discussion workshops to explore operational risks will be illustrated in Section 3 as part of the case study. However, it is worth pausing here to highlight the main benefits of holding regular group workshops (or individual interviews) to discuss operational risks.

The primary benefit is that workshops are an effective means for engaging the people in the business who know the most about operational activity. Business experts should ideally be involved in every stage of the risk assessment process, not least the risk identification step, because they are best placed to offer insight into the outcomes associated with operational failure and the drivers of uncertainty. Workshops involving (relevant) staff drawn from across the business are key to:

- Eliciting a complete description of the operational risk universe
- Understanding the dynamic relationships that exist between the causes of operational loss
- Removing (by design) the cognitive bias and narrow focus present when only single individuals are consulted

FIGURE 5: WHICH OF THE FOLLOWING PROCESSES DOES THE BUSINESS USE TO IDENTIFY OPERATIONAL RISK EXPOSURES?
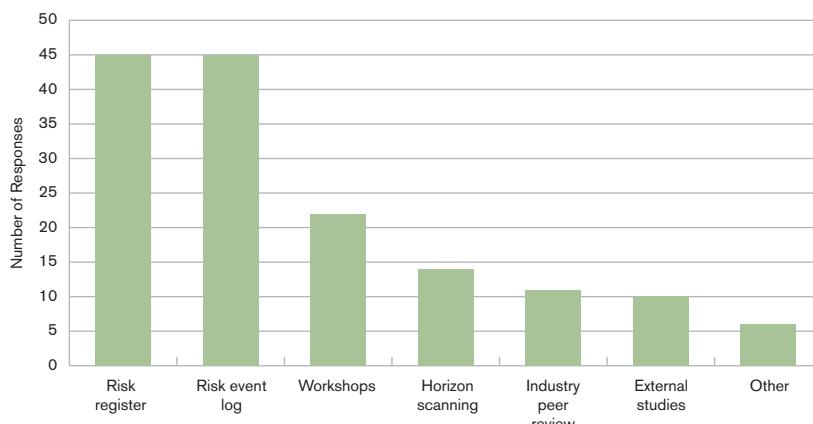
As may be expected, given the inputs and processes used (summarised in Figure 5), the outputs that the Board and other committees typically receive from the risk assessment framework were of a similar level of sophistication. Loss event recording (46 respondents), heat maps (41 respondents), and KPIs (34 respondents) were the most commonly reported items. However, a far lower number of respondents (16) reported 'near misses' to the Board/Risk Committee. This is to be expected, given the correspondingly low number of firms that currently record such events, but such data can be a very valuable source of insight into the current level of operational risk. For example, data on near misses may indicate potential weaknesses in the risk mitigation and control framework.

FIGURE 6: WHICH OF THE FOLLOWING ARE REPORTED TO THE BOARD AND/OR RISK COMMITTEE IN RESPECT OF OPERATIONAL RISK?
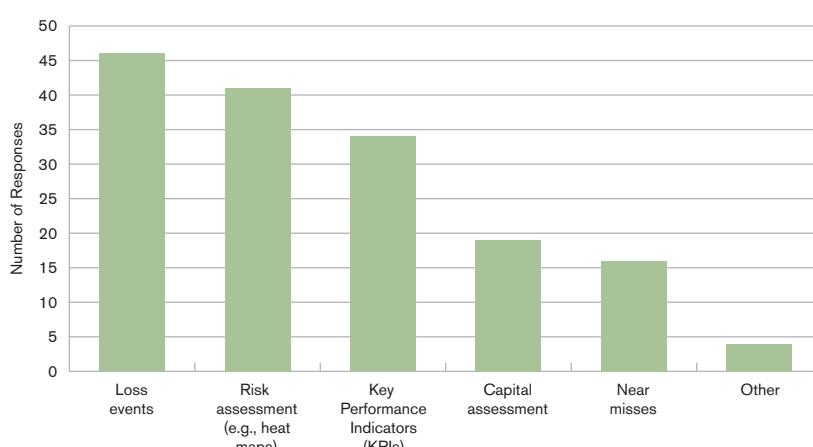
2.3 Modelling

For those companies that intend to quantify the financial losses, capital impact, or other outcomes associated with operational risks, there are a number of techniques available of varying maturity and sophistication. As illustrated by the key result from our survey shown in Figure 7, the modelling of operational risk is not yet a widespread practice in Asia; only 24% of respondents stated that they modelled operational risk.

■ Model Operational Risk
■ Don't Model Operational Risk
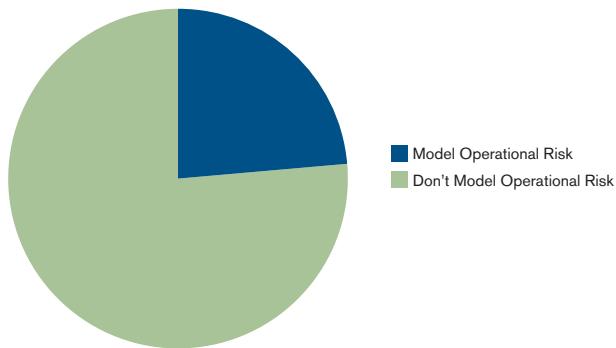
This section reviews the modelling which does take place in the context of:

- Methodology used within the model
- Primary operational risks modelled
- Review of operational risk models

However, due to the small sample size, care should be taken before drawing any firm conclusions from the survey responses.

As discussed in detail in the Milliman research report 'Operational Risk Modelling Framework,' an operational risk model can usually be assigned to one of four classes of approach, namely:

1.   A simple formula based on key business metrics (e.g., the Solvency II standard formula 'add-on' for operational risk capital)

2.   Scenario analysis

3.   Statistical models (e.g., the loss distribution approach)

4.   Causal/structural modelling (e.g., a Bayesian network approach)

From a purely technical perspective, the degree of sophistication can generally be said to increase as you move down the list of methods. That being said, valuable insight into potential losses can still be gained from any of them as long as the limitations of, and assumptions behind, the approaches are well understood. Causal models are a relatively new methodology for assessing operational risk but they offer the ability to understand and explain the causes of operational uncertainty as well predict future losses.

Of the companies that model operational risk, over 80% do so using either a 'scenario approach' (60%) or a simple formula (20%). It should be noted, however, that 40% of these companies have plans to develop their operational risk modelling within the next year. The majority of the companies that do not currently model operational risk (55%) use some sort of qualitative assessment instead. As companies like this move towards establishing a modelling framework for the first time, they should take care to retain the knowledge built up through qualitative assessment and incorporate it into their risk models wherever possible.

Where operational risks were modelled, 'execution, delivery, and process management' and 'clients, products, and business practice' frequently ranked highly when measured in terms of potential losses. At the other end of the scale, very few (if any) firms included 'employment practices,' 'damage to physical assets,' or 'loss of intellectual property' within their list of top five risks by financial impact.

This is broadly consistent with the observations made regarding the degree to which certain operational risks are discussed within the business. Responses to an earlier question on the survey suggest that risks with a lower perceived capital impact, such as damage to infrastructure or the loss of intellectual property, receive less attention during operational risk conversations. This is, of course, more an indication that firms are at least prioritising higher-impact risks within their risk management frameworks rather than confirming that these specific risks carry a lower impact.

However, the survey does reveal one example of potential inconsistencies in current operational risk frameworks. As noted in the previous section, the survey results indicate that 'change management' is another risk that is less frequently discussed by businesses, despite modelling revealing that the risk can be very significant when assessed in terms of financial impact. This serves as a good example of the need for an integrated approach if operational risk frameworks are to be effective at managing risk. Inconsistencies between the different components don't necessarily suggest that errors have been made but usefully point to areas where further investigation and discussion is required to ensure the framework is aligned to the current operational risk profile.

FIGURE 8: WHAT ARE YOUR TOP FIVE OPERATIONAL RISKS BY CAPITAL IMPACT/PROJECTED LOSS?
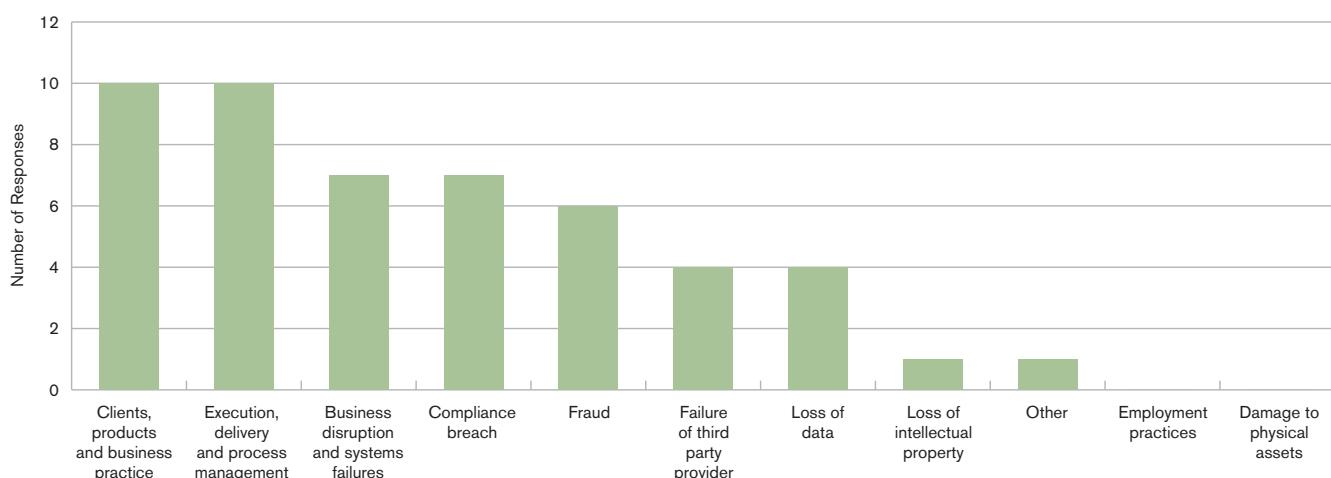
As for all models, ensuring that operational risk models have been thoroughly reviewed is critical to ensuring that the chosen methodology and assumptions have been implemented correctly. Requiring this review to be carried out by a party independent from the model development and calibration process attaches further credibility to the model from the perspective of users of the model output, such as function heads, risk committees, the Board, etc.

Encouragingly, only 30% of the companies were yet to have their operational risk models reviewed at the time they completed the survey. Most firms' operational risk models had been reviewed by an external party, whilst one company stated that its model had been the subject of a regulatory review. Another 20% of respondents stated that both a regulatory and external review had been conducted on their models. The areas that garnered most attention during the review processes were reporting, assumptions, and methodology. Less focus was placed upon management buy-in and model use, though we would expect these areas to increase in importance as best practice continues to develop.

FIGURE 9: WHICH AREA(S) DID THE REGULATOR FOCUS ON IN ITS REGULATORY REVIEW?
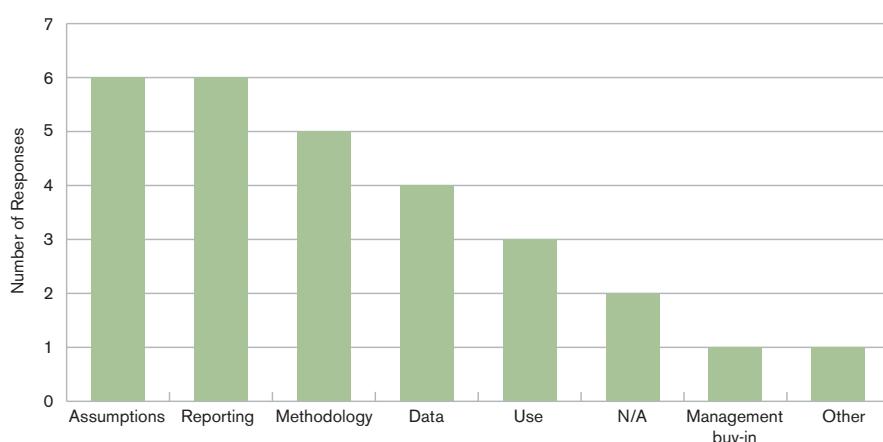
2.4 Data

One of the main challenges within any risk framework is the availability of relevant data. Ideally, the data collected will be homogeneous, complete, reliable, and of a sufficient quantity to make any analysis and conclusions based on it credible. Unfortunately for operational risk events, such data sets are quite difficult to gather and for certain specific risk exposures, data may not yet exist in any usable quantities. Historical data can also be unhelpful if the underlying mechanisms producing the loss change over time, and therefore the data does not represent observations of the same distribution.

A robust loss data collection process requires a framework to specify what information needs to be collected as well as clearly articulating the collection process itself. In this context, it is perhaps unsurprising that, for those firms that have an operational risk model, the survey showed that data was a key challenge.

The most prevalent source of data for those companies which model operational risk was internal data, supplemented by expert judgement. A few firms also mentioned the use of external data within their models. The majority of respondents to the survey (90%) believed that having access to external loss data, in addition to historical internal data, would help in the assessment of future operational risk events. However, in contrast, the majority (96%) of respondents did not possess a subscription to an external loss database.

FIGURE 10: ABILITY TO ACCESS EXTERNAL LOSS DATABASE COMPARED WITH THE BELIEF THAT ACCESS TO HISTORICAL DATA IS IMPORTANT

Legend:
- Believe access to historic data is important
- Do not subscribe to external loss database
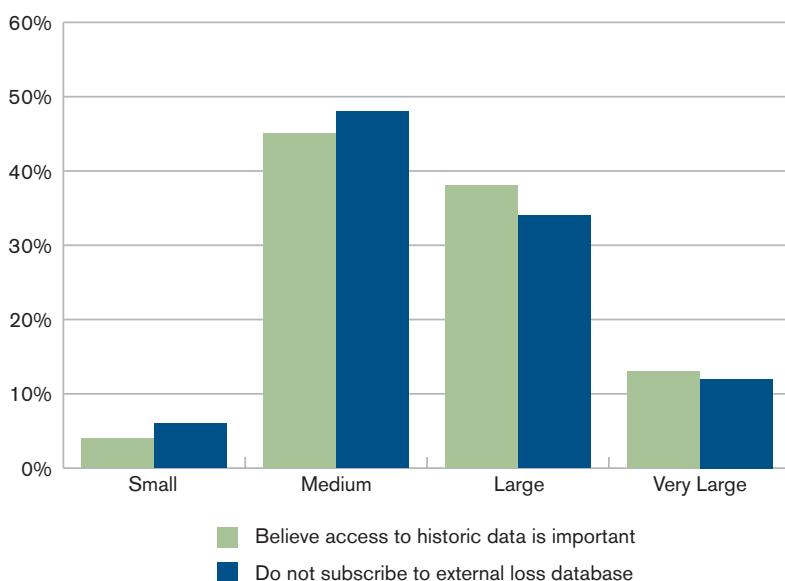
External loss databases can be useful in increasing the volume of data available for calibration of an operational risk model or to identify new or emerging risks that have yet to be recognised internally. Databases such as those maintained by the Operational Riskdata eXchange Association (ORX),[5] the UK-based Operational Risk Consortium (ORIC),[6] or Japan's Risk Data Bank (RDB)[7] contain increasingly rich information with respect to operational risk events. As a greater number of companies begin to contribute loss information and the level of granularity and detail in the data capture forms increases, the databases can only become more useful.

Any source of external data has its limits; incorporating information from an external loss database into internal risk frameworks will always require careful interpretation, scaling, and an awareness of the methods by which the data has been collated. Differences in the way in which individual companies internally collect and record information means that collating and categorising this data at an industry level will always be somewhat imperfect. This is made more challenging by inconsistencies in the type or significance of events that are included in the loss recording. For example, many companies will prefer to only report risk events with moderate or large impacts, and ignore near misses and minor events. Finally, operational processes and the risks that arise from them can be very specific to a company's unique structure and business practices. This unavoidably leads to further heterogeneity in the data, making it difficult to group or classify in a meaningful robust way.

5   ORX Association. ORX Data. Retrieved December 23, 2015, from http://www.orx.org/Pages/ORXData.aspx.
6   See ORIC International website at http://www.oricinternational.com/risk-intelligence/.
7   The Risk Data Bank of Japan, Limited. Operational Risk Database. Retrieved December 23, 2015, from http://www.riskdatabank.co.jp/english/service/operational.html.

In terms of the type of information that firms record in their risk registers and event logs, the survey indicates a very broad range of data items. These are summarised in the graphs in Figure 11.
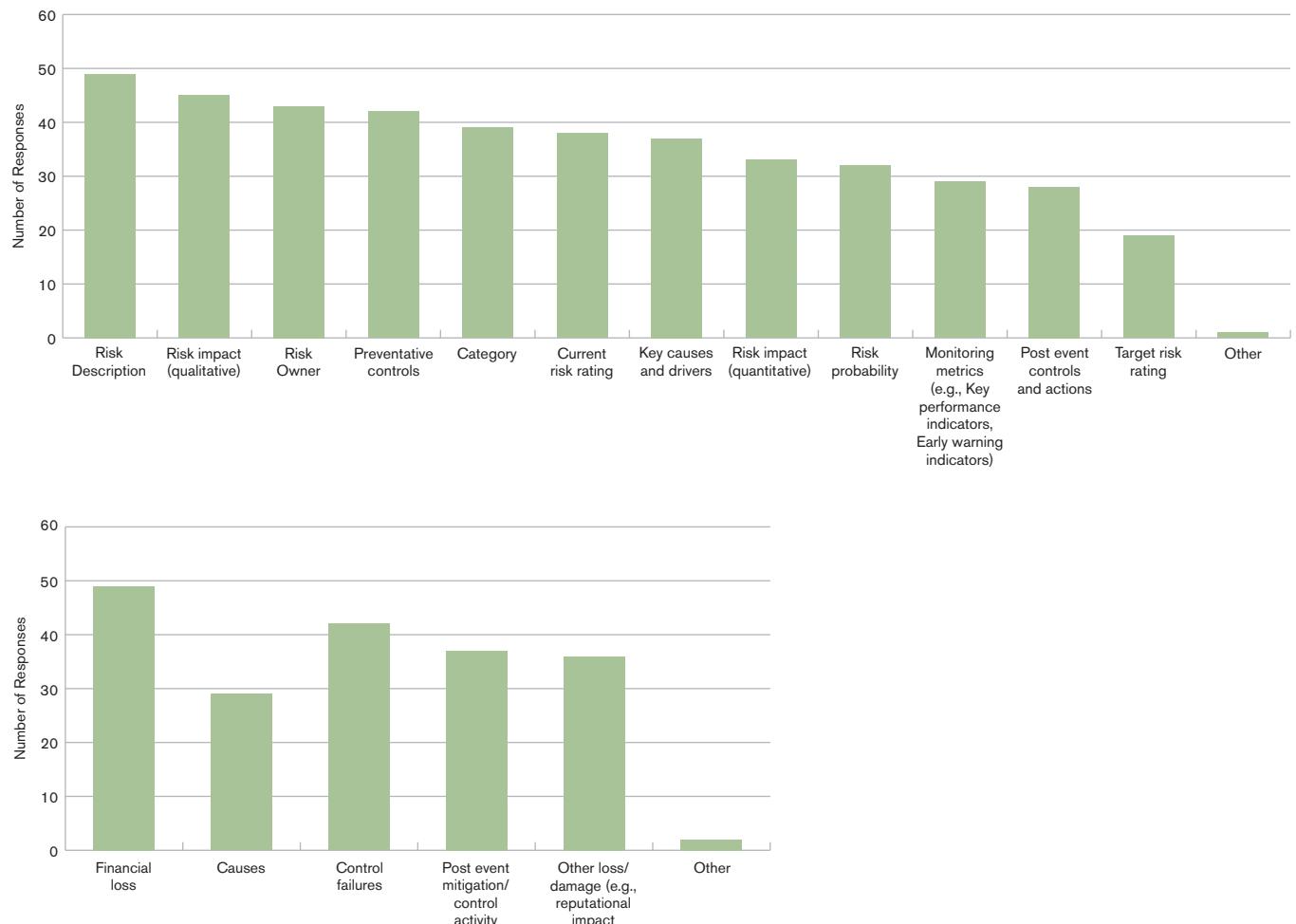
2.5 Use

So far we have considered the design and implementation aspects of an operational risk framework. But no matter how sophisticated the risk management information (MI), how accurate the model calibration, or how comprehensive the risk assessment, the success of any particular framework will always depend heavily on how well and how widely it is embraced by the business.

If companies are to successfully align their strategic objectives with their own operations, then embedding the operational risk framework within the day-to-day activity of the business is critical. Integrating the framework in a company's practices and culture should not simply be driven by regulatory expectations.

To assess the degree to which existing operational risk frameworks are used by Asian insurance companies, the survey covered the following topics:

- Areas of use within the business
- The level and frequency of operational risk training
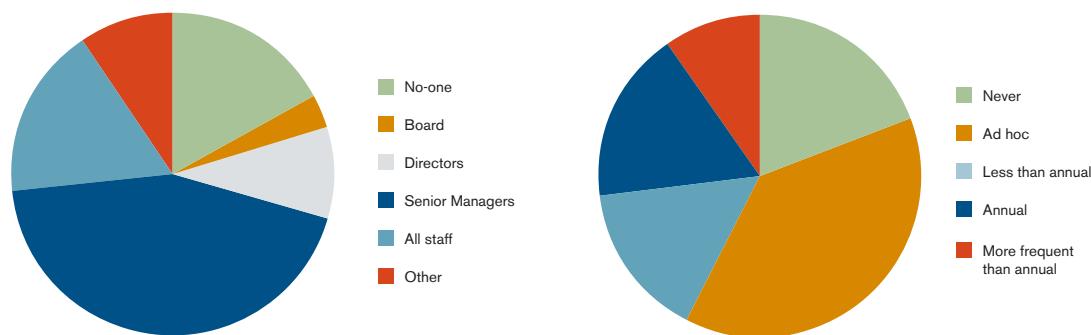- Responsibilities surrounding the operational risk assessment

The responses indicate that, for most companies, the results of the operational risk assessment are used in the 'usual' areas within a company, namely regulatory capital, business planning, and scenario testing. Very few companies (8%) stated that they used the results for the purposes of reverse stress testing. This is perhaps because reverse stress testing would be difficult to carry out within a qualitative or 'simple modelling' framework, which most respondents seem to have in place. Techniques such as causal modelling using Bayesian networks can help in this regard, as the methodology can enable companies to identify which set of circumstances or series of events may lead to large operational risk events.

With regard to training in operational risk, the survey results indicate that training is typically focused on senior managers, and even then is often only provided on an ad hoc basis. A number of respondents stated that no operational risk training was in place and few indicated that any training was implemented at the Board level.

If firms assume that their employees have an up-to-date understanding of the operational risks within the business, there are clear dangers. Operational risks do not stand still; the level and form of risk changes with both the business and the environment in which it operates in complex, sudden, and often unexpected ways. Targeted training across the business must be an on-going exercise so that:
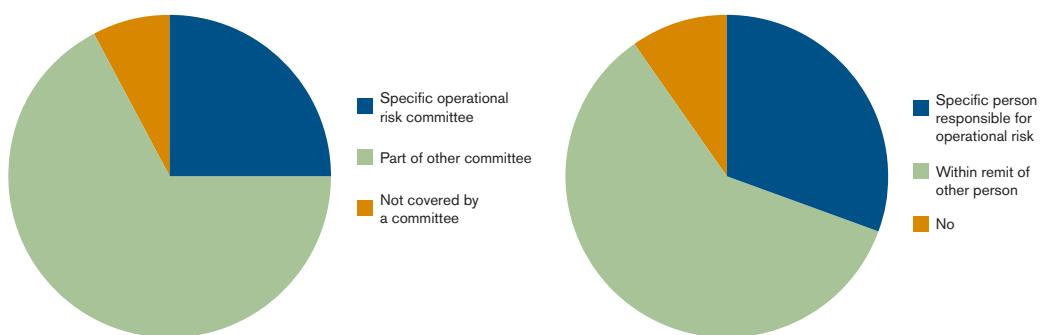
▪ Members of staff understand the link between their work and the corresponding operational risks created.

▪ Managers understand the outputs from the risk framework, enabling them to assess and control operational performance.

▪ Board members can make strategic decisions informed by the current and forecasted operational risk profile of the business.

FIGURE 12: WHO RECEIVES OPERATIONAL RISK TRAINING? HOW OFTEN IS OPERATIONAL RISK TRAINING GIVEN?

Legend (left pie):
- No-one
- Board
- Directors
- Senior Managers
- All staff
- Other

Legend (right pie):
- Never
- Ad hoc
- Less than annual
- Annual
- More frequent than annual

Within the European insurance industry, we have seen an increase in specific roles (e.g., Head of Operational Risk), departments, and committees tasked with operating and overseeing the operational risk framework. However, the majority of respondents to the survey (67%) did not have specific committees for operational risk, and instead amalgamate operational risk into another committee. Similarly, responsibility for operational risk lies within the remit of another employee for a large number (60%) of respondents.

FIGURE 13: OPERATIONAL RISK COMMITTEES AND RESPONSIBILITY FOR OPERATIONAL RISK

Legend (left pie):
- Specific operational risk committee
- Part of other committee
- Not covered by a committee

Legend (right pie):
- Specific person responsible for operational risk
- Within remit of other person
- No

Ultimately, operational risk should be something that all staff engage with and take ownership for. However, acquiring a holistic view of the risk profile, identifying the common dependencies between risks, and reporting this insight back to the business is likely to be best achieved by persons with overall responsibility for and expertise in operational risk.

2.6 Summary

Whilst most of the responding firms are aware of the potential occurrence and impact of operational risk events, operational risk is currently less integrated within the risk management cultures of Asian firms than in other more developed markets. Current risk assessment techniques therefore provide little management value other than acknowledging the existence and level of operational risk. This is predominantly due to the use of silo risk modelling approaches, a lack of feedback within the reporting processes, and a low amount of operational risk data.

However, it is interesting to note that risk workshops are increasingly used within the Asian market. Although these workshops are currently largely limited to the general management of the business, the involvement of different business areas and operational units allows a much wider discussion of risks. Involving executives in this process would enable a firm's risk management culture to be further embedded throughout the business by communicating a consistent message from the top.

For Asian firms willing to invest adequate time and resources, and involve expertise from across the business, it may now be an opportune time to look at implementing causal techniques.

3 PROCESS OVERVIEW

3.1 Complexity-science-based approaches

There are a variety of tools which are widely used today to assess operational risk; however, each of these tools has its own flaws. When used together they fail to provide a consistent, holistic view of the operational risk profile of a business. The statistical models, risk registers, and loss databases that comprise traditional operational risk frameworks are rarely greater than the sum of their parts and often disenfranchise the very business people who are managing the risks.

Tools which are used to quantify operational losses, including the more well established formula or statistical-based methods, suffer from a variety of problems, such as:

- No, or limited, links with the actual loss generating mechanism

- Selection bias with respect to which scenarios are quantified

- Point estimates rather than full distributions of losses

- Aggregation which fails to take proper account of the dependencies between risks

Critically, these methods provide no meaningful bridge between managing and modelling operational risk

Milliman has pioneered a new approach to operational risk based on 'complexity science,' which directly addresses the weaknesses of more traditional tools. Basing our practical methods for risk management on complexity science not only provides them with a solid scientific grounding but also ensures that the methods:

- Are rigorous, robust, and repeatable

- Are more intuitive and useful to non-technical personnel

- Provide insight into the mechanism and not just the final outcome

- Enable simultaneous insights into multiple outcomes, not just capital

- Enable better resilience planning

At the heart of using a complexity science approach is the idea that businesses display the characteristics of complex adaptive systems. If we adopt this view it quickly becomes clear that we cannot address real business problems by breaking the system down into its component parts and studying them in discrete silos. Fully understanding risk requires a holistic view, because the dynamic, emergent behaviour of a system is defined by the interactions and relationships of its component parts.

The continued reliance on statistical approaches is based on the idea that complex outcomes must be the result of complex behaviour and interactions of the individual parts of the system, which are too difficult to model directly. Complexity science reveals that these complex outcomes can, and often do, emerge because of simple underlying behaviours. Armed with this knowledge, it becomes possible to understand how and why certain business outcomes occur.

To obtain a complete description of the system we need to combine the knowledge and expertise of people from the business with relevant data relating to historical experience, current indicators, and industry trends. In other words, we make use of both what we know and what we can see. This insight provides the starting point for the process that we have developed for identifying, understanding, and quantifying operational risk.

3.2 Case study process

The following section serves as a general introduction and overview of the individual steps that were carried out for the case study project. The tools and methods which make up Milliman's approach to developing enhanced risk management frameworks are not restricted to insurance companies. They are readily applicable to firms in any industry or geographic location, and scale naturally to whatever degree of sophistication is required.

The remainder of the report is devoted to describing the specifics of the case study project. In particular, we will highlight the insight gained at each stage of the process and address the challenges which emerged as a result of working within a less mature existing risk management framework.

Figure 14 shows the main steps in developing an operational risk framework using an approach based on complexity science.

FIGURE 14: DEVELOPING AN OPERATIONAL RISK FRAMEWORK
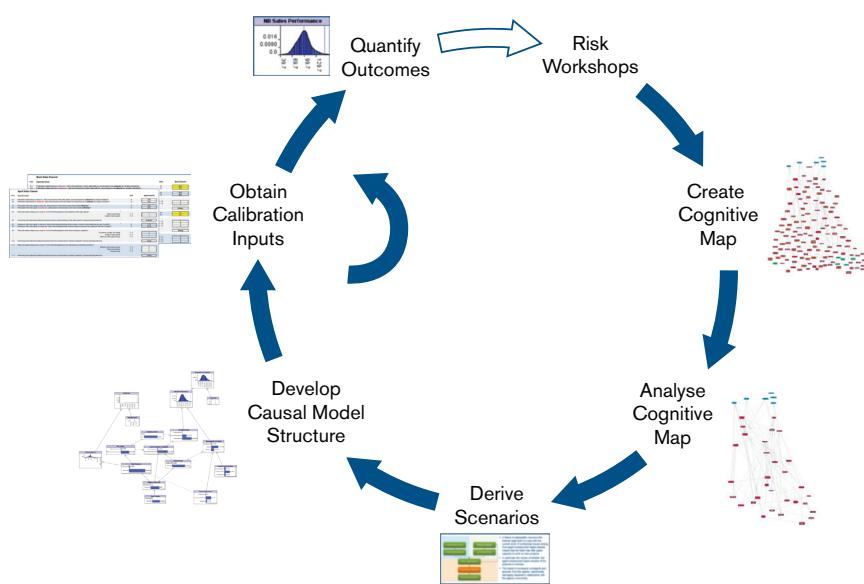
Risk discussion

The first step in the process is to hold a series of workshops in which the participants discuss the factors that could influence the behaviour and outcomes associated with a particular risk scenario or business strategy. The workshops should take the form of a facilitated discussion in which the risk team poses a series of open questions. This ensures that the participants cover the relevant business outcomes and drivers of uncertainty in sufficient breadth and detail without the risk team introducing any bias.

The primary purpose of the workshops is to elicit a complete description of the universe in which the risk exists at a level of detail necessary and sufficient for the task at hand but no more. This should include a description of the relationships between different processes and the pathways by which operational performance could deteriorate.
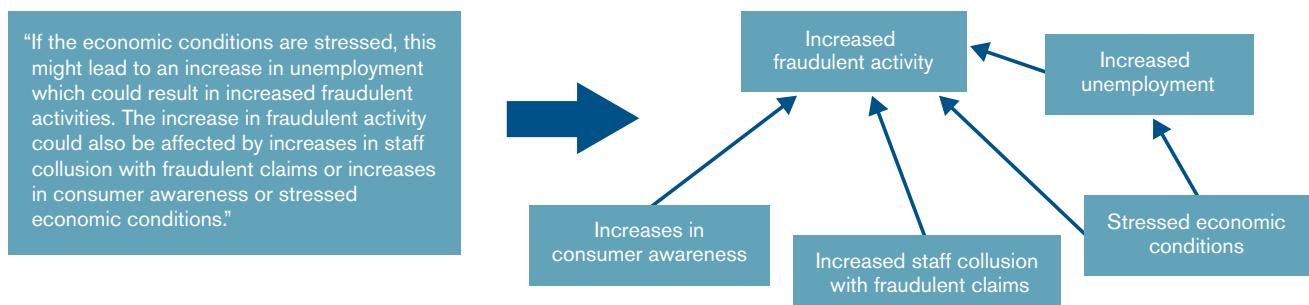
The workshops should ideally involve business experts representing a broad range of departments, e.g., sales, risk, underwriting, actuarial, claims management, etc. This helps to ensure that the narrative output from the workshop is both comprehensive and free from bias. Where appropriate, the workshop discussion can be supplemented with further input from other stakeholders.

Cognitive mapping

To develop a complete profile of the chosen risk scenario we translate the workshop discussion into a cognitive map. Cognitive mapping is a process for identifying the constituent elements of a problem and connecting them to produce a non-linear, visual representation of the problem. The technique provides a robust, transparent framework for beginning to understand the underlying complexity of a system.

To produce the cognitive map, each individual concept or idea mentioned in the discussion is identified from the workshop write-up. They are then connected according to the relationships defined in that discussion. This process is illustrated in Figure 15 below.

FIGURE 15: CONSTRUCTING THE COGNITIVE MAP

"If the economic conditions are stressed, this might lead to an increase in unemployment which could result in increased fraudulent activities. The increase in fraudulent activity could also be affected by increases in staff collusion with fraudulent claims or increases in consumer awareness or stressed economic conditions."

Parts of the narrative from the workshop may be too brief or seem unfinished, either because of time constraints or because certain risk dynamics are not well understood. An initial review of the map allows us to identify any such gaps or inconsistencies in the narrative. This generates a list of follow-up questions, which are used to iterate the map to ensure it provides a complete and consistent description of the risk scenario.

Where multiple workshops are conducted, separate cognitive maps can be produced for each discussion before consolidating them within a single cognitive map.

One of the advantages of cognitive mapping is that the narrative is presented in a form which we can formally analyse to identify the key features required to understand the behaviour of the system. By collapsing the map onto just these key features, we obtain a 'minimally complex' summary of the system. This view contains sufficient complexity to realistically reflect the risk, but is sufficiently simple so that it can be readily understood by a wide audience.

In the context of our case study project, the minimally complex map provided us with a candidate structure for the causal model used to quantify the outcomes associated with operational risk. However, cognitive mapping also has a number of further risk management applications, such as validating a firm's risk register or informing the choice of KRIs.

Using the analysed cognitive map for stress scenario selection is particularly valuable. Referencing the map ensures the set of scenarios has comprehensive coverage of the risk profile and provides an outline for each individual scenario by identifying the source and pathway by which it occurs.

Causal modelling
Causal modelling techniques allow us to relate the loss (or losses) associated with a particular risk scenario directly to the underlying drivers of uncertainty. A causal model is named as such because it retains the dynamic links between causes and losses, so risks are viewed in context. Causal models, such as Bayesian networks, can generate full, non-linear loss distributions, providing the user with a better understanding of the range of potential outcomes.

The process to construct a causal model starts with the minimally complex summary of the risk scenario identified through the cognitive mapping process. The concepts and relationships contained in that summary directly inform the candidate structure for the model. The model is then calibrated using a combination of expert judgement, historical data, and business inputs. The model dynamics and corresponding loss distributions must then be rigorously validated to ensure the model accurately represents the current profile of the operational risk exposure being investigated.

The model calibration sessions should preferably be attended by the same business experts who provided the scenario description in the initial risk workshops. They should be asked to approve the proposed model structure and provide an initial set of model parameters, which can then be investigated further with reference to relevant data where available. Involving the business at all stages of the model development is critical to building and maintaining engagement, so that the model is used by more than just the risk or actuarial functions.

The finalised model permits a wide range of interrogation, including analysis of single and multi-factor 'bottom-up' scenarios, 'top-down' reverse stress tests, and comprehensive sensitivity testing. Ideally, use of these analytical tools is more than just a technical exercise. By providing a more complete understanding of past business outcomes and improved forecasts, they can be used to improve decision making and business planning by:

- Answering 'what if…?' questions for improved resilience planning
- Assessing the effectiveness of management actions
- Identifying key areas to control or develop

4 RISK DISCUSSION

When developing a new operational risk framework or enhancing an existing one, we typically recommend that firms start by describing their overall operational risk exposures. This is best achieved by going through the workshop and cognitive mapping steps outlined in Section 3.2 above with the firm's senior executives, to obtain an understanding of the mechanisms by which the strategic objectives of the firm are achieved. The discussion should be at a sufficient depth to identify where key areas of uncertainty can arise for operational reasons; the resulting minimally complex map then provides a summary of the key features of the organisation's operational risk profile.

Our partner firm had a preference for focusing the case study on the new business sales process. In most businesses, new sales are a critical driver of growth and therefore relate directly to any strategic objectives which are defined in terms of value generation.

The company currently sells business via tied sales agents and through bancassurance agreements. It was therefore interested to see how the new techniques could be used to capture differences in the dynamics of the performance and behaviour of its two main distribution channels.

There are multiple components to the new business sales 'story' which no one individual area of the business will know completely, therefore all relevant stakeholders should be included within the workshops to capture the complete narrative. Consulting multiple groups gives insight into different perspectives across the business and therefore helps to produce an unbiased view of the operational risk profile.

To elicit a complete description of the operational risks associated with new business sales, we therefore held three separate workshops which were each attended by relevant personnel from the partner firm. The three workshops were as follows:

1. **Bank channel:** Attended by those responsible for managing the relationship with the bank through which the partner firm's products are sold.

2. **Agency channel:** Attended by business experts from the firm's administration and operational functions.

3. **Sales process 'supervisory' functions:** Attended by representatives from the firm's legal, audit, compliance, and risk management departments.

4.1 Before the workshops

Employees within the business will typically have limited opportunities to take time away from their main day-to-day activities, and it is often challenging to find time which fits the schedules of multiple people. It is therefore essential that efficient use is made of the time in the workshop, so as to reduce (but not eliminate) the possibility of needing further follow-up sessions.

This is best achieved by asking the invited participants to spend some time preparing in advance of the workshop so they don't arrive 'cold' to the discussion. Invitees should be sent introductory documentation explaining the purpose of the workshop, how the discussion will be structured, and suggestions of relevant information it might be useful to look at before coming to the workshop.

In the case of the new business risk discussion, invitees were informed that the workshop would have the following broad structure:

- Identification of the strategic objectives related to the sales distribution channels, such as:
  - Market position
  - Level of sales
  - Brand profile/reputation
  - Regulatory compliance
  - Consumer and sales advisor confidence

- Discussion around the processes or events that might lead to the company failing to meet any or a combination of these objectives. This may involve discussions of:
  - Staff dependencies
  - System dependencies
  - External events

- Consideration of the controls and mitigants already in place with respect to the distribution channels

- Determination of links with other operational risks within the business

In terms of background reading, the invitees were asked to review any existing material relating to the company's sales process, including:

- Business plan

- Sales and marketing materials

- Regulatory rules with respect to distribution

- Internal risk information, e.g., risk register, loss database, KPIs, other risk reporting

- Newspaper articles, industry analysis, etc.

Ideally, the workshops should be facilitated by someone without a direct interest in the topic of discussion, which limits the use of leading questions and the introduction of bias. For the case study, Milliman consultants facilitated the workshops, but on an on-going basis a firm's risk management function is well suited to lead the risk discussions.

Nevertheless, it is valuable for the workshop facilitator to have a general knowledge of the area of the business being discussed to ensure that no major areas are overlooked during the discussion. Therefore, the partner firm provided us with a number of documents including:

- KPIs from the sales departments relating to sales performance, profitability, and new business servicing quality

- KPIs from the legal department relating to the sales force, e.g., contracts, disputes, lawsuits, complaints, etc.

- Recent audit reports covering the agency and bank distribution channels

- KRIs with respect to customer issues, e.g., personal data, complaints, mis-selling, etc.

Reviewing these materials provided useful background knowledge to the firm's sales process and indicated where potential areas of uncertainty could arise. For example, sales force contractual issues, compliance breaches, failure to achieve sales targets, and poor market share.

4.2 During the workshops

The workshops began with high-level discussions centred on the firm's new business objectives and then progressed into exploring the operational processes which influence sales performance and downside risk. This enabled information to be captured on the different factors which may damage new business performance and identified the types and sources of operational failure associated with distribution.

In the remainder of this section, we have provided a summary of the discussions which took place within the workshops.

Objectives
In respect of any one year, each of the two distribution channels is set the primary objective of achieving 100% of their new business sales targets. These targets are based on the agreed business plan and defined in terms of premium volume, rather than number of policies. To achieve its target, the bank channel focuses on providing attractive, competitively priced products. This contrasts with the agency channel, where providing a high-quality policyholder service throughout the sales process is considered the main driver of sales. To support the growth in the sales capability of the agency channel, the business also set a secondary objective to materially increase the size of its agent sales force.

The main objectives of the control or 'supervisory' functions relate to minimising the risk of any regulatory, compliance, or legal issues which arise out of the sales process, for example policy mis-selling or legal disputes with agency staff. To achieve this, the functions set out standards and procedures which must be adhered to throughout the sales process, and also offer advice to the firm's staff as well as its policyholders.

Product design
Product attractiveness was primarily discussed in the context of the financial characteristics of the firm's product range, i.e., the premium rates offered to customers and the level of remuneration paid to sales advisors. The high degree of competition in the current market was a key theme of the discussion, with participants highlighting several specific areas relevant to the firm, including:

- The uniformity in the firm's major product lines when compared with equivalent products in the market, increasingly making price the single most important factor in determining sales volumes.

- The existence of other comparable financial products in the bank channel against which the firm's insurance products must also compete.

- The bargaining power held by banks in setting the terms under which products are offered through the bancassurance channel. Participants commented that this would further increase as the pressure between banks competing for market share grows.

- The difficulty of offering attractive savings products in a low interest rate environment, where there is only limited scope for accessing diversified investment instruments.

- The challenge of selling a competitively priced product whilst also offering attractive commission and remuneration terms to the sales channels.

- Regulatory challenge over the launch of new products and/or the continued sale of the firm's most popular existing products (see below).

Regulation of new business sales
The Taiwanese insurance regulator, The Insurance Bureau, continues to take an active role in its duty to supervise the sales activities of life insurance companies. Participants made the general observation that the regulator tended to approach issues from the customer perspective when assessing current sales practices. Workshop discussions focused on three key areas related to the regulatory landscape, these were:

1. Concern from the regulator regarding a perceived imbalance between the sale of savings-type contracts and more protection-oriented insurance products, such as whole life or accident and health business. In recent years, the regulator has actively intervened by encouraging the sale of products it considers to be 'real' insurance, and in some cases requiring that the sale of certain savings products be suspended.

   Workshop participants did not believe that these steps would do much to dampen consumer demand for savings-type products, meaning that they would continue to dominate the market at least in the short to medium term.

2. The regulator also expressed concerns about the level of competition in the market, in terms of both the premium rates offered to policyholders and the level of sales compensation paid. Again, the regulator has taken measures to address these concerns, such as discouraging 'above market' levels of sales remuneration and validating that premium rates charged to customers match those proposed at the offer stage.

3. Workshop participants stressed the importance of having an effective compliance framework in place, particularly in an evolving regulatory environment, where there is a constant need for product innovation. The compliance system needs to be capable of monitoring the wide spectrum of areas which impact and are influenced by new business sales. These include actuarial pricing, sales remuneration scales, product and marketing literature, agent licensing, and the sales process itself.

Agency-specific issues
During the agency channel discussion, participants noted that the current initiative to expand the number of sales agents would need to be managed carefully, so as to minimise the recruitment of agents who would be terminated soon after as a result of poor sales performance. Otherwise, achieving planned sales levels and growing market share would come at the expense of wasted resources.

Participants in the agency channel workshops also discussed the need to review the allocation of sales remuneration between the agency management and the sales agents themselves. There was concern that insufficient financial incentives for the sales agents would have a negative impact on both the recruitment process and retaining existing agents.

Representatives from the firm's legal function during the 'supervisory' workshop raised the issue of agent contract terms. Consistent, clearly defined, and robust contract terms between the insurer and the agent are critical to:

- Maintaining strong relations with the agent base

- Making efficient use of the resources and availability of the legal team

- Minimising reputational damage and/or regulatory intervention as a result of agency disputes

Participants also discussed recent agent fraud cases within the industry, the majority of which had involved large operational losses, regulatory actions, and adverse media coverage. Cases of fraud ranged from inadequate record keeping of premium receipts to agents creating false 'off the book' insurance policies.

Bank-specific issues
In the current market, the degree to which banks choose to prioritise the promotion of insurance products is heavily biased towards the competitiveness of those products. If the insurer is able to offer products that are priced in line with the market, then the quality of the sales service will be an important factor in maintaining support from the bank. However, if the insurer's products are not competitive then it is unlikely the bank will actively market this business, regardless of the level of service.

Workshop participants also highlighted that a single approach applied to all bank branches would be ineffective due to the differences in accounting and training systems between branches, and also in the quality of each branch's financial advisors.

5 RISK PROFILING

5.1 Recap on cognitive mapping

As described in Section 3.2 above, cognitive mapping allows an account of a problem to be broken down into its constituent elements, by illustrating the complex interconnected factors in diagrammatic form. Cognitive maps are a valuable tool for succinctly capturing all of the different, interrelated threads of a discussion. They are especially useful where conversations involve multiple participants with different areas of expertise or where the topic is complex.

Cognitive mapping is well suited to capturing discussions with respect to operational risk exposures, which are rarely related to just one department or activity and are subject to considerable uncertainty. The approach recognises the importance of the strategic as well as operational 'layers,' and the process provides a robust, repeatable, and complete description of the risk system.

A full written record of a risk workshop in a traditional document form accurately captures the detail but retains the linear nature of the discussion, whereas representing the discussion in a cognitive map recovers the interactions between the components mentioned in the workshop.

Summarising the risk discussion within the entries of a risk register can be an efficient means of recording the key features of an individual risk exposure but necessarily loses much of the detail from the discussion. Furthermore, the choice of what to include in the register is subject to the bias and interpretation of the risk owner. Cognitive maps retain the complete depth and detail from the risk discussion, but also permit the key features of the narrative to be differentiated from any surrounding context in an unbiased way through robust analysis.

Cognitive mapping can be applied to the identification and development of a suite of stresses or scenarios. Use of cognitive maps helps to ensure the scenarios are realistic and meaningful to the business, and allows detail to be considered without sacrificing coverage of the wider system. It also helps to identify both obvious routes to failure, and more subtle ones.

5.2 Constructing the cognitive map

To construct the map, each individual idea or concept mentioned within a risk workshop is translated into a 'node.' Links are then inserted between these nodes to directly reflect the way ideas were related to each other during the discussions.

Using the above method, individual maps were prepared in respect of each of the three workshop discussions which were held to discuss new business sales risk. To make interacting with the map easier, nodes were colour-coded to differentiate between outcomes (e.g., reduced new business sales, regulatory fine, etc.), risk drivers, and controls.

Figure 16 shows a subset of one of the cognitive maps, where the solid lines represent connections between the nodes shown and the dotted lines show further connections to other nodes not explicitly shown in this view.

FIGURE 16: EXTRACT OF FULL COGNITIVE MAP
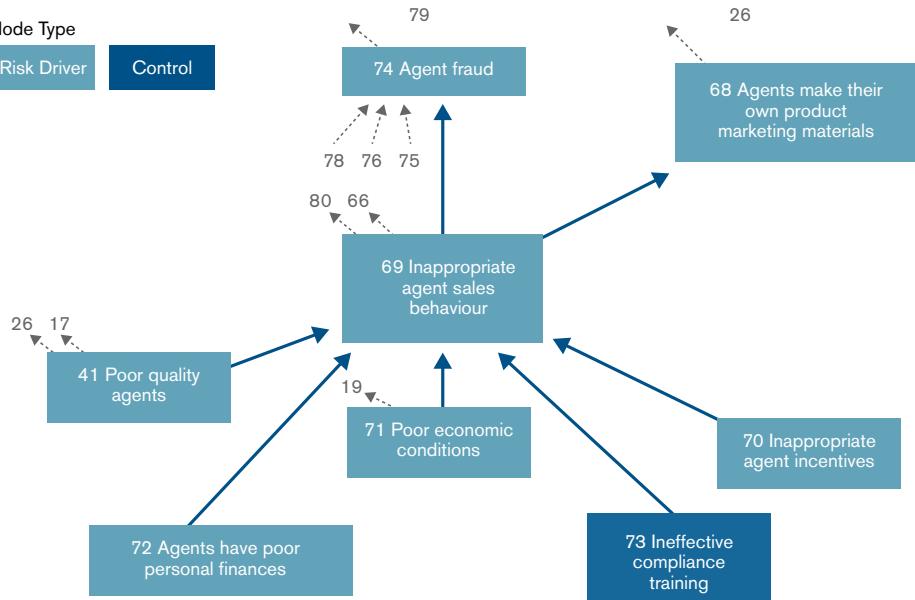
The maps were then reviewed to identify any obvious missing links or under-explored areas of the story relating to new business distribution. This review generated a set of follow-up questions, which were directed to the relevant areas of the business; responses were then used to supplement the original workshop output and update the map to obtain a complete view of the areas discussed.

The three maps were then consolidated into a single map to give a complete description of the risk profile. Concepts that were common to more than one map were merged to uncover the links between the areas discussed during different workshops. Once all the content from the workshops had been translated into the single consolidated map, the map was restructured to introduce a more instinctive, upward flow to the various causal relationships. As will be seen later, this allows scenarios to be traced though the map from an initial failure to an adverse outcome.

The map was then further structured to group together nodes according to broad themes; which makes engaging with the map, even at a high level, much easier and provides an overview of the areas that a comprehensive set of risk scenarios will need to cover. The themes used to structure the final map for new business sales risk were as follows:

- Reputation
- Financial
- Customer
- Agent sales
- Bank sales
- Product
- External

Figure 17 shows the structure of the final cognitive map where the different thematic areas have been highlighted.

FIGURE 17: FULL COGNITIVE MAP
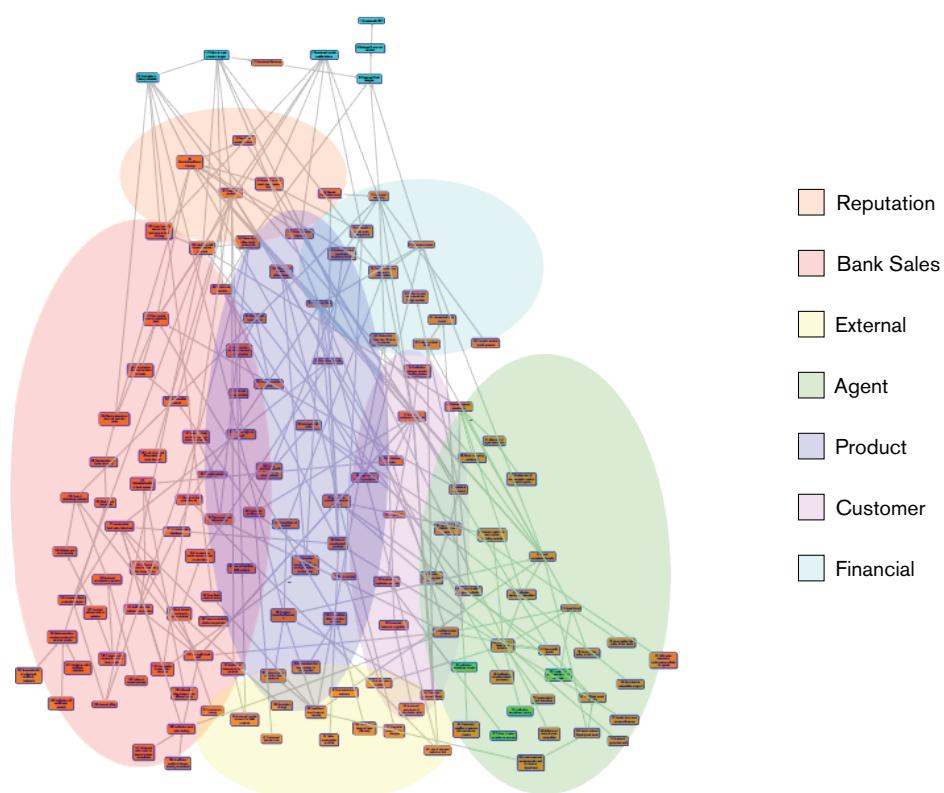
5.3 Analysing the cognitive map

The finished map captures everything from the three separate risk workshops in a single view and is structured in a way which allows individual pathways or concepts related by a common theme to be readily identified and explored. However, as a result of retaining all the richness and breadth of information, the map contains over 100 nodes with over 200 connections between them. Somewhat inevitably this makes the map very difficult to digest as a whole and does not immediately reveal the components which are essential to understanding the risk profile. We therefore need to consolidate the map further still, collapsing it down to just the key features and removing any surrounding context, which provides us with the minimally complex view.

In order to do this, we look for three types of nodes:

Outcomes
'Outcomes' are those nodes which reflect the impacts of operational failure such as increased costs, lower capital, reduced new business volumes, or reputational damage. These nodes should already have been identified during the map construction phase and, ideally, should sit at or towards the top of the map.

Within the pilot case study, the following were identified as the outcomes of new business sales failure:

- Unsuccessful initial public offering (IPO)
- Decreased market position/share
- Reduced three-year net income
- Reduced profit margins
- Failure to meet premium targets
- Reduction in sales production

It is important to note that distinguishing between outcomes and risk drivers is a somewhat subjective judgement. For example, something like a regulatory fine is clearly an outcome related to, say, a compliance breach, but it is also itself a driver of increased outgo and reduced solvency and reputation. In practice, the distinction is not important as long as the important concepts find their way into the minimally complex view as either an 'outcome' or one of the types of nodes identified though the connectivity analysis described below.

From a classification perspective, the nodes which are identified as 'outcomes' are those which the business is particularly interested in exploring in the context of the scenario (e.g., reduced sales production, failure to meet premium targets, etc.) or the wider strategic objectives of the firm (e.g., unsuccessful IPO, reduced annual income, etc.).

Critical
'Critical' nodes represent those concepts from the original risk discussions which are fundamental to defining and understanding new business distribution within the firm. Removing one or more critical nodes from the minimally complex view would create a gap in our understanding of the key drivers of uncertainty.

Critical nodes are identified by looking for the most connected nodes in the map, i.e., the most highly linked to other nodes. There are two types of these nodes. First are the nodes characterised by a high 'domain' score, meaning that they are directly connected to a large number of nodes. Secondly, there are nodes with a high 'centrality' score, meaning that they are referenced by a large proportion of the overall map through indirect connections. Critical nodes are therefore selected by separately ranking all nodes in the map by their domain and centrality scores. To ensure that the key features and dynamics of the risk profile are captured, it is important that we include both types of critical nodes.

For the pilot case study into new business sales risk, analysis of the cognitive map identified the critical nodes shown in the table in Figure 18, split out into high-level categories.

FIGURE 18: CRITICAL NODES RELATED TO NEW BUSINESS DISTRIBUTION				
COMPLIANCE	**ADMINISTRATIVE**	**SALES SUPPORT**	**PRODUCT**	**STRATEGIC OBJECTIVES**
Regulatory fines	Increase in customer complaints	Agent complaints/lawsuits	Unattractive product	Increase in losses or expenses
Increase in mis-selling/ misrepresentation	Inefficient sales process	Reduced number of agents		Reputational/brand damage
Compliance breach	Insufficient legal resource capacity	Agent contract issues/ inefficiencies		Poor market share in individual bank
Sales of unauthorised products		Ineffective bank sales training		Unable to sell required product volumes
Inappropriate agent or bank sales behaviour		Low-quality bank staff		
Agent fraud				

Potent

'Potent' nodes represent the concepts from the discussions which are linked to several critical nodes. The identification of potent nodes is key to understanding the main exposure points which could lead to a range of operational failures.

Potent nodes are identified by ranking all of the nodes in the map (except for critical and outcome nodes) by the number of different critical nodes they are linked to, either directly or via a pathway.

For the pilot case study into new business sales risk, analysis of the cognitive map identified the potent nodes shown in the table in Figure 19, split out into high-level categories. A failure or deterioration in performance in one of these areas will influence multiple drivers of successful new business sales.

| FIGURE 19: POTENT NODES RELATED TO NEW BUSINESS DISTRIBUTION				
COMPLIANCE	**ADMINISTRATIVE**	**SALES SUPPORT**	**INVESTMENT**	**PRODUCT**
Loss of personal customer data	Ineffective data maintenance process	Insufficient agent training	Poor growth in assets under management	Unattractive remuneration structure
		Legal resources predominantly used for agency department	Fall in markets and poor economic conditions	
		Agent system/employment basis		

5.4 Minimal complexity

Collectively, the three categories of nodes identified by following the above process (i.e., the outcome, critical, and potent nodes) represent the key features of the risk system. In order to simplify the description of the risk profile to make it more practical for risk management purposes, these key features must be retained (as a minimum) so that the dynamics of the risk can be properly understood. Reducing the full cognitive map so that only these key nodes remain provides the 'minimally complex' view as illustrated by Figure 20.

FIGURE 20: MINIMALLY COMPLEX VIEW

Complete Description of Risk System   Minimally Complex View
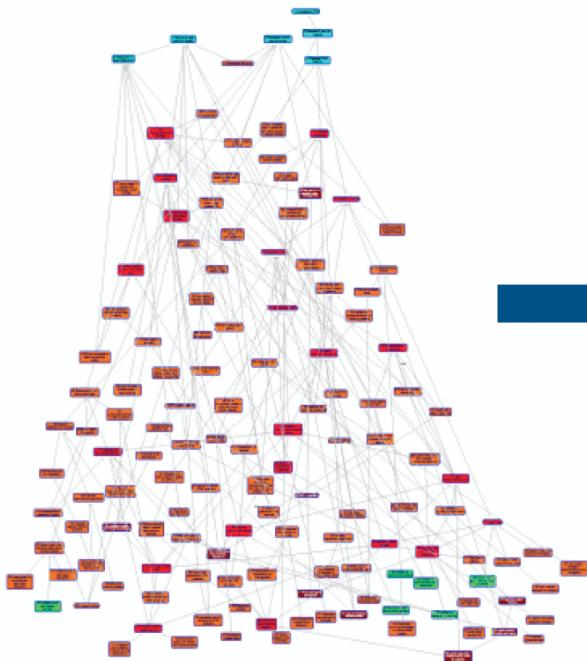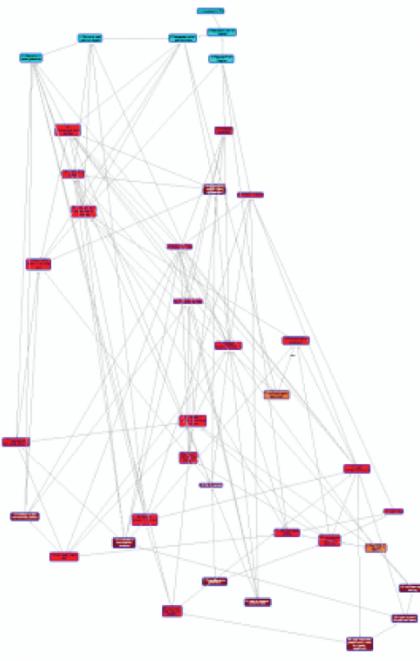
Full Cognitive Map   Collapsed onto Key Nodes

The fully analysed cognitive map can then be applied to a wide range of risk management applications, including:

- Risk register validation
- Selection of KRIs
- Scenario construction
- Model design

The latter two applications will be discussed in more detail in Section 6 and Section 7, respectively, below.

6 SCENARIO GENERATION

6.1 Overview

As mentioned in Section 3.2 above, cognitive maps have many valuable uses, one of which is the creation of stress scenarios.

Formulating stress scenarios using a cognitive map facilitates resilience planning by allowing firms to consider the pathways and causes which could lead to failure. This enables the identification of areas which may require further risk mitigation or controls. Stress scenarios created using cognitive maps also help to clarify which scenarios to test within the causal model (see Section 7 below), ensuring that the key scenarios are captured within the quantitative analysis. Reference to the cognitive map also helps to ensure that the scenario descriptions are sufficiently specific to the company and the environment in which it operates, rather than being generic or standard descriptions, which are less meaningful to the business.

Scenarios are identified by studying the condensed (i.e., minimally complex) view of the cognitive map and drawing interesting pathways between the critical, potent, and outcome nodes. Pathways which combine more than one themed area of the cognitive map are particularly interesting, as differing areas are not often considered alongside each other.

Additional scenario pathways should be produced until each critical and potent node within the minimally complex view is included in at least one pathway. This ensures that the final set of scenarios has complete coverage of the key areas of uncertainty.

Once the initial pathways have been identified, additional nodes are included from the full cognitive map to provide additional context to the scenarios. These finalised pathways form a framework around which a narrative for the scenario can be formed.

The process for developing a scenario description using the cognitive map is summarised below.

FIGURE 21: SCENARIO DEVELOPMENT PROCESS

Cognitive Analysis   Minimally Complex View   Scenario Pathways   Scenario Description
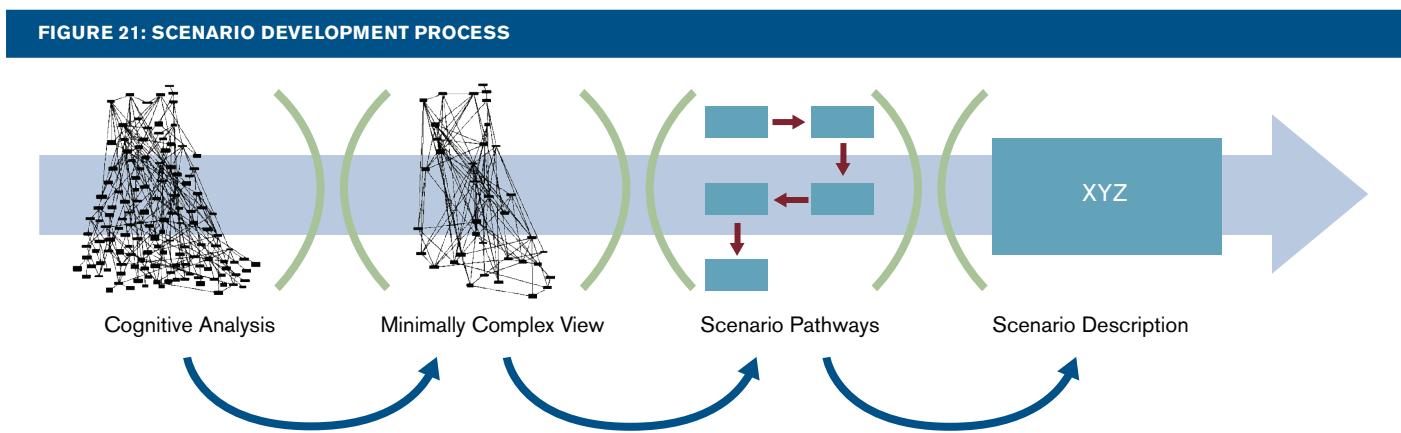
With respect to the case study project, Milliman consultants followed the scenario definition process and identified five candidate stress scenarios related to new business distribution. They were then reviewed by the partner firm's representatives and refined where necessary to improve alignment with the business.

Each of the five scenarios is related to one primary area of uncertainty discussed during the risk discussion workshops, which were as follows:

- Training
- Remuneration
- Legal resources
- Agent fraud
- Product design

Collectively, the scenarios described in the remainder of this section provide a comprehensive coverage of the risk profile related to new business distribution. However, it is important to note that these scenarios represent only a subset of the many possible scenarios which could have been elicited from the cognitive map.

6.2 Case study scenarios

Scenario 1: Agent training

For the first scenario, the business wanted to explore the potential consequences of providing reduced or insufficient training to new and existing sales agents. To develop the outline of this scenario, a pathway was traced from the potent node 'Insufficient agent training' through the connected nodes further up the map in a logical fashion, until one or more outcome nodes at the top of the map were reached.
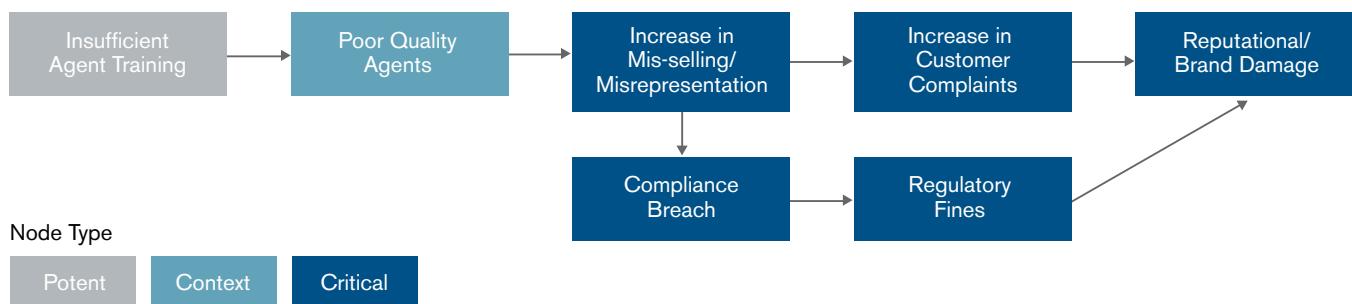
The pathway for this scenario as a subset of the wider minimally complex map is illustrated in Figure 22.

FIGURE 22: SCENARIO 1 PATHWAY
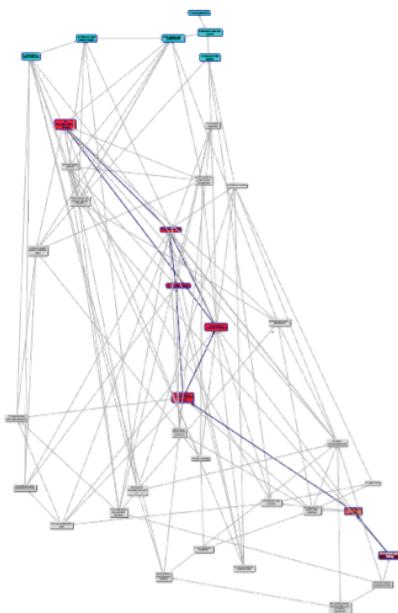
The diagram in Figure 23 shows the nodes included within the scenario pathway and the connections between them.

FIGURE 23: SCENARIO 1 OUTLINE

This pathway was then expanded into a brief narrative description of a potential adverse scenario which has been reproduced below.

'The life company does not deliver effective agent training with respect to current regulation, industry best practice, and product knowledge. This leads to a gradual decline in the ability of sales agents to offer compliant advice and meet Company's required sales standards.

Out-of-date and incomplete sales advice leads to increased incidence of product mis-selling across Company's product offering.

A build-up of customer complaints is picked up by industry press and the regulator decides to review Company's current sales practice.'

Expanding the concepts within the scenario outline into this narrative form provides a scenario description which is less abstract and more meaningful to certain key stakeholders, such as department heads, Board members, and Risk Committee members.

If a causal model is developed based on the structure of the minimally complex cognitive map (see Section 7 below), the above scenario could be implemented within the model to quantify the expected impact on sales volumes following deterioration in the training provided to sales staff.

Qualitative assessment is important alongside quantitative assessment. Operational failures often lead to more than just financial loss and modelling does not in isolation provide the solutions as to how to avoid or manage adverse scenarios.

Therefore, the scenario description should ideally also form the basis of further discussion with specific business areas or with the Board and senior management to identify:

▪ What steps should be taken immediately or in the short to medium term to limit the adverse impacts associated with a particular scenario

▪ The contingency plans necessary to manage the business if the scenario should occur

▪ Improvements to existing controls or new controls which can be implemented to reduce the likelihood or frequency with which the scenario is expected to occur

▪ Areas where further investigation is required to better understand weaknesses in the business's internal operations or its relationship with key stakeholders and the external environment

▪ Practices in areas of the business that are performing well, which might be replicated elsewhere

Scenario 2: Agent remuneration
The second scenario begins with a failure to adequately remunerate the business's sales agents, and is summarised by the pathway shown in Figure 24.

FIGURE 24: SCENARIO 2 OUTLINE
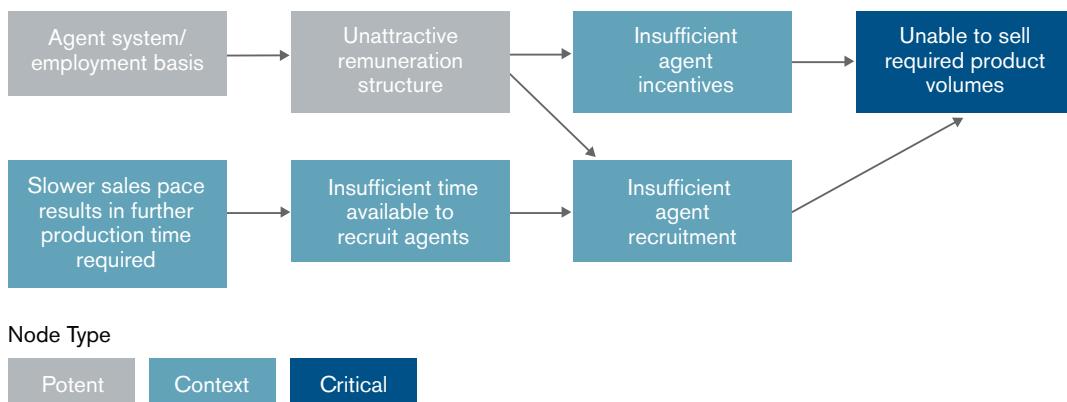
This outline was expanded into the following narrative for the scenario:

> *'Under the current agent employment basis, a growing proportion of sales commission is retained by agency managers instead of being distributed to agents. Over time this has eroded the attractiveness of agent remuneration, reducing the incentive for agents to pursue sales targets. This is accompanied by a steady decline in the number of agents.*
>
> *The business fails to identify the issues in a timely manner and increase efforts to recruit new agents. The difficulty recruiting new agents is exacerbated by the uncompetitive remuneration structure.*
>
> *Over time there are not enough agents or production per agent to meet sales targets.'*

Scenario 3: Bank sales training
The third scenario begins with a failure to provide sufficient training to the bank branch sales staff, and is summarised by the outline shown in Figure 25.

FIGURE 25: SCENARIO 3 OUTLINE
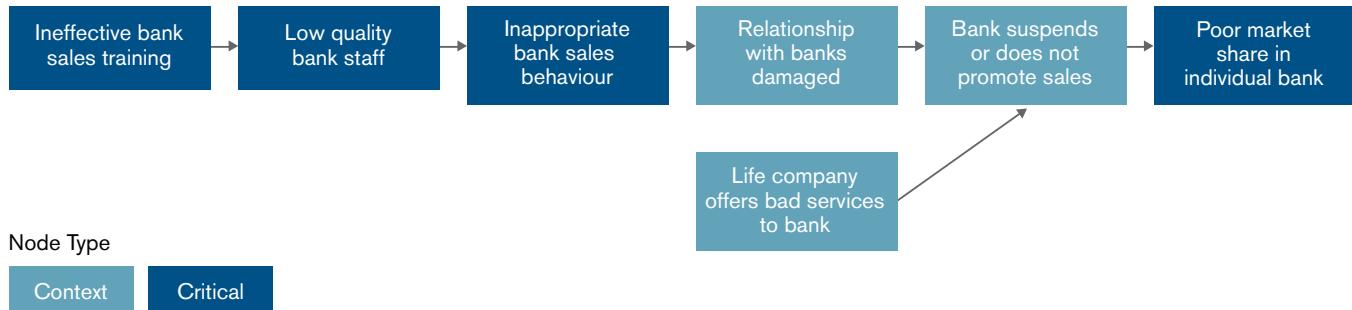
This outline was expanded into the following narrative for the scenario:

> 'The life company fails to keep the training of bank staff up to date with current regulation and industry best practice.
>
> Increased complaints from existing bank customers raise concern within the bank that the life company is failing to adequately manage the sales process.
>
> This is accompanied by deterioration in the quality of sales support and the new business processing capability offered to the bank.
>
> The bank decides to deprioritise sales of insurance products leading to a significant reduction in new business generated through the bank channel.'

Scenario 4: Agent fraud
The fourth scenario explores the potential impact of an increase in fraud committed by the business's sales agents, and is summarised by the pathway shown in Figure 26.

FIGURE 26: SCENARIO 4 OUTLINE
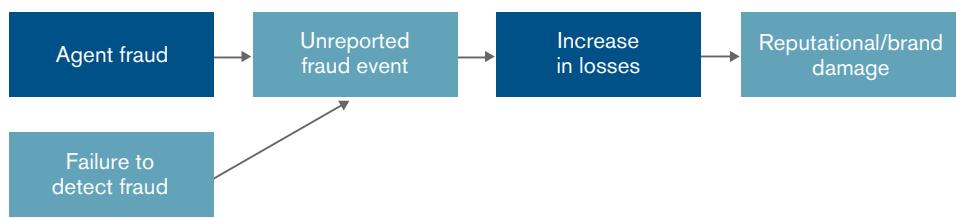
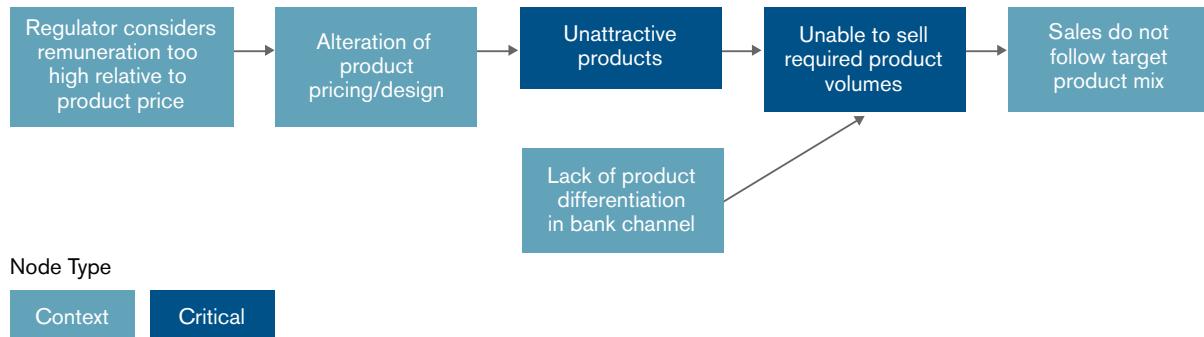This outline was expanded into the following narrative for the scenario:

> 'An increase in attempts by sales agents to write fraudulent insurance policies goes undetected until a number of large claims pay-outs are made on fraudulent policies.
>
> The company is unable to fully reclaim the erroneous payments and suffers reputational damage from the failure of internal controls.'

Scenario 5: Product design

The final scenario explores the consequences and outcomes associated with selling an unattractive product in the marketplace, and is summarised by the pathway shown in Figure 27.

FIGURE 27: SCENARIO 5 OUTLINE

This outline was expanded into the following narrative for the scenario:

'*A recent re-price of the life company's key product line is out of step with the current market. Repricing was due to regulatory concern on compensation being too high relative to premiums. As a result, uncompetitive premiums and remuneration combined with a lack of product differentiation reduces the attractiveness of products through the bank channel to certain segments of the market.*

The company experiences an overall reduction in new business volumes through the bank channel and a less desirable business mix than anticipated in the pricing basis.'

7 CAUSAL MODELLING

7.1 Introduction to Bayesian networks

So far we have seen how comprehensive risk discussions together with rigorously applied cognitive mapping have been used to:

- Identify the key components and relationships which drive the firm's new business process

- Generate a set of adverse scenarios that cover the operational risk profile of the new business process

However, this insight into the component parts of the firm's new business process can also be taken a step further and used to develop a model of future new business volumes and any other quantifiable impacts arising from sales activity. To retain the dynamics and dependencies identified through the cognitive map process, we used a type of causal model known as a Bayesian network.

Bayesian networks are a type of probabilistic model that permit uncertain outcomes to be modelled based upon an explicit link to the underlying drivers of that uncertainty. Put more simply, they allow us to model both the cause and the effect. Bayesian network models do not return a single, specific outcome, but instead estimate how likely each possible outcome is conditional upon the state of the causal processes related to that set of outcomes.

Bayesian networks consist of a connected set of 'nodes,' each of which represents a distinct process, control, or impact associated with the firm's new business process. Probabilistic relationships are defined between each node to represent the way in which the business expects the state of one node to affect the state of other nodes in the model.

For a more detailed introduction to Bayesian networks applied to operational risk modelling, please see the Milliman research report 'An Operational Risk Modelling Framework,' available here:
http://us.milliman.com/uploadedFiles/insight/life-published/operational-risk-modelling-framework.pdf.

In the context of the case study, building a model based on the causal structure implied by the cognitive mapping allowed us to explore how the elements of the new business process are expected to influence new business performance.

In contrast with non-causal approaches to modelling, where the distribution of future new business volumes might typically be estimated directly without any explicit reference to the underlying drivers, the case study model developed to replicate the dynamics of the firm's new business process has two distinct but connected parts:

1. A causal model for the probabilities associated with the different (discrete) states associated with each component of the new business process, for example:

    - Quality of sales staff, adequate/inadequate

    - Sales process, efficient/inefficient

    - Product pricing, uncompetitive/in line with the market/competitive

2. Conditional probability distributions for each of the outcome variables, which are dependent on the underlying causal model, for example:

    - New business volumes

    - Losses from fraudulent sales

For the remainder of this section we explain how the case study model of the new business process was structured and then calibrated. In Section 8 below, we then look at the analysis that was carried out within the modelling framework.

7.2 Model structure

The starting point for the structure of the causal model of the firm's new business process is the 'minimally complex' view of the cognitive map, which is determined by collapsing the full map on to just its key features (as described in Section 5.4 above). Further simplification may then be required in order to derive the final structure of the causal model.

For example, any outcomes which are not directly quantifiable or which we do not wish to quantify should be removed from the minimally complex map, along with any critical or potent concepts that relate to just those outcomes. To further simplify the model structure, it may also be possible to combine two or more similar or closely related concepts into a single concept without compromising the model's ability to realistically reflect the key dynamics of the system.

To build the structure of the causal model, each concept in the adjusted version of the minimally complex cognitive map is translated into a node in the Bayesian network. As described in Section 7.3 below, the links from the map are transferred across but are now used to indicate explicit probabilistic dependencies rather than qualitative causal relationships. The translation from the minimally complex cognitive map for the agency channel new business process to the corresponding causal model structure is shown in Figure 28.

FIGURE 28: MAP TO MODEL TRANSLATION STEP
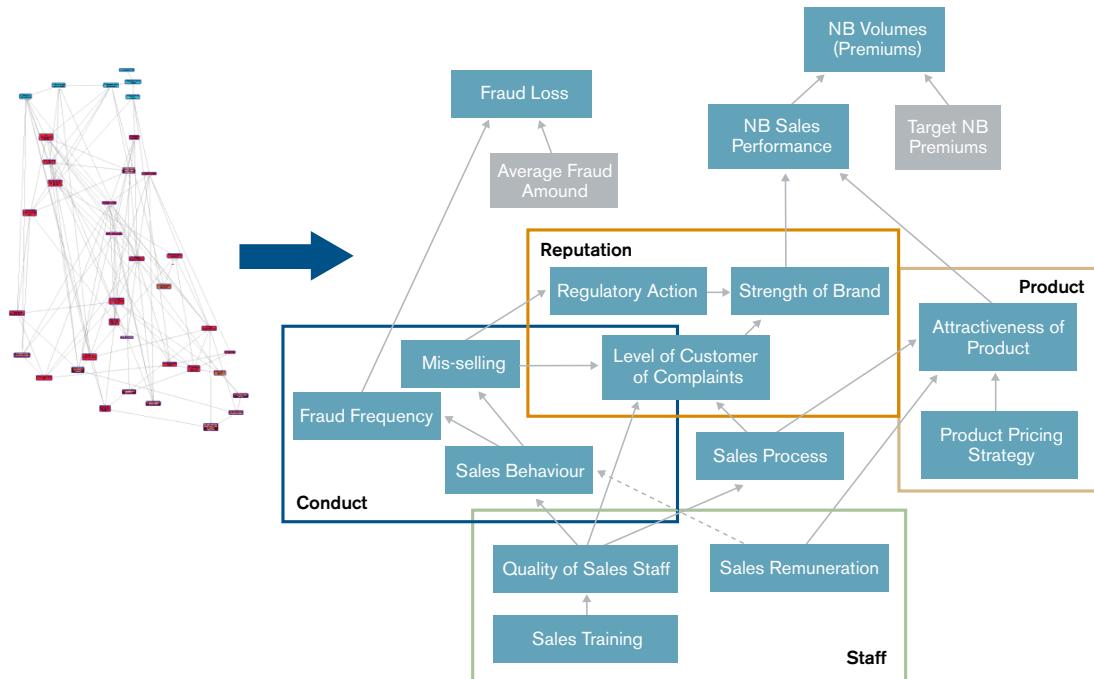
7.3 Model calibration

Causal models for operational risk, such as the one constructed in the preceding section, are calibrated by using three main sources of information: fixed business inputs, historical KRI data, and expert judgement.

1. *Business inputs*

    Business inputs are typically taken from the business plan and can include target premium volumes (as used in the case study model), budgeted expense levels, or best estimate claims levels. However, other items related to the planned development of the profit and loss (P&L) or balance sheet may also be used, such as investment return rates or current asset values.

    Use of business inputs provides a tangible frame of reference around which the business experts can anchor their views about the outcome(s) and level of uncertainty they expect under different circumstances. Updating the business inputs on an on-going basis provides a straightforward mechanism for ensuring the model output remains consistent with the scale of the firm and the current business plan.

    To set the initial calibration of the model, the case study firm provided planned new business volumes split by distribution channel and an assumption for the average loss incurred as a result of fraudulent policy sales.

2. *KRI data*

    Where firms have KRIs or metrics in place that correspond to particular causal drivers found in the model, and also have access to the recent history of those metrics, then this data can be used directly in the calibration process. For example, a firm's experience data in relation to fraudulent sales in each of the last few years could be used to derive an estimate of the proportion of future fraudulent cases out of total new business sales.

    Alternatively, if it cannot be used directly, then KRI data may be a valuable source of information upon which experts base their judgements regarding the initial calibration of the model, or later on to use as evidence of the continued appropriateness of the current calibration.

3. *Expert judgement*

If there is no or only limited relevant historical data available, as is often the case when considering operational risk (especially within the less mature ERM frameworks found in some Asian insurance markets), then expert judgement will initially be the main basis for the model calibration, at least until such time as sufficient experience data has been built up.

When selecting individuals to participate in the model calibration process, they can be either internal or external to the firm, but the goal is to obtain a group that collectively has a comprehensive, up-to-date, and in-depth understanding of the area of operational risk considered. A group rather than a single individual should normally be consulted to limit the scope for subjectivity or bias influencing the model calibration. If facilitated and managed properly then the discussion itself can be a valuable part of the risk management process.

For the case study model, representatives from the agency and bancassurance distribution channels, as well as the administrative, legal, and compliance functions within the firm, were invited to participate in the calibration process.

The causal drivers within the model are typically represented by discrete nodes, and as such are modelled based on the simplifying assumption that at any one time they only occupy one of a (small) number of distinct states. For example, in the case study model, the quality of the firm's sales agents can be either 'adequate' or 'inadequate.'

For each causal driver, the business experts must therefore first specify the states within the node, each of which should be discernibly different from the other states, and make sense in the context of the other components of the model which depend on this node. The business experts should be guided towards selecting only as many states as are necessary to describe different behaviour or outcomes. Ensuring that each state is accompanied by a clear definition, which will be interpreted consistently across the firm, can greatly assist both the initial calibration and the on-going use of the model as a business tool. The state definitions can also be used when setting up driver-specific KRIs to monitor the operational areas of the business captured by the model.

Once the states have been defined, the business experts are asked to provide an estimate of the probability that the driver will occupy each of these states in the 12-month period from the chosen calibration point. For independent nodes in the model, experts are asked to provide unconditional probability estimates, e.g., there is a 20% chance that sales training will be 'inadequate.'

For dependent nodes, which are causally related to other nodes 'further down' the model, experts must provide probability estimates that are conditional upon the states of the underlying nodes, e.g., there is a 10% chance that sales staff will be 'adequate' if sales training is 'inadequate.' The overall probability distribution for the node is then resolved using an application of the law of total probability, i.e., by multiplying the conditional probability distribution associated with each state (or combination of states) of the underlying causal driver(s) by the probability of being in those states.

In the subsection of the agency distribution model shown in Figure 29, business experts were asked questions such as:

– *"What is the probability that sales training will be 'adequate' over the next 12 months?"* to calibrate the independent node representing the quality of the firm's sales training.

– *"What is the probability that the quality of sales staff will be 'inadequate' if sales training is also 'adequate'?"* to calibrate the dependent node representing the quality of the firm's sales agents.

FIGURE 29: DISCRETE NODE CALIBRATION
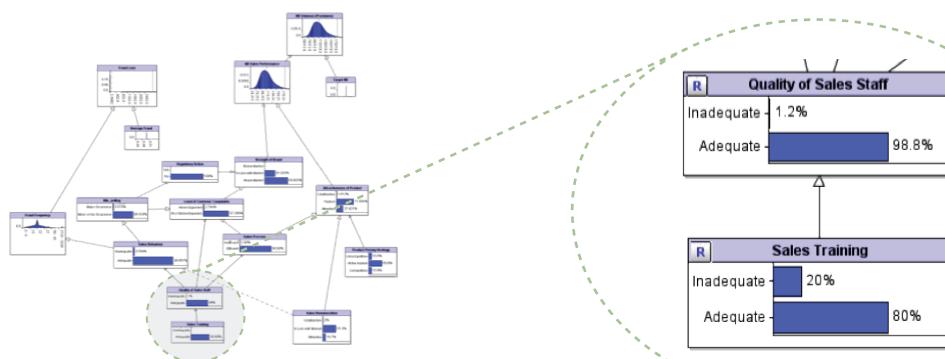
For dependent nodes it is also possible to specify the calibration using a ranked approach in which the relative influence of the underlying causal drivers on the node in question is specified. This can be particularly helpful where there are a large number of dependencies which would otherwise lead to an even larger number of states upon which the probability estimate must be conditioned.

For example, in the subsection of the agency distribution model shown in Figure 30, business experts were asked *"What is the relative influence of the following factors on the level of customer complaints: the occurrence of mis-selling, the quality of sales agents, and the efficiency of the sales process?"* The experts responded by assigning an integer weighting, e.g., 1 to 5, to each driver of these nodes.

FIGURE 30: RANKED NODE CALIBRATION
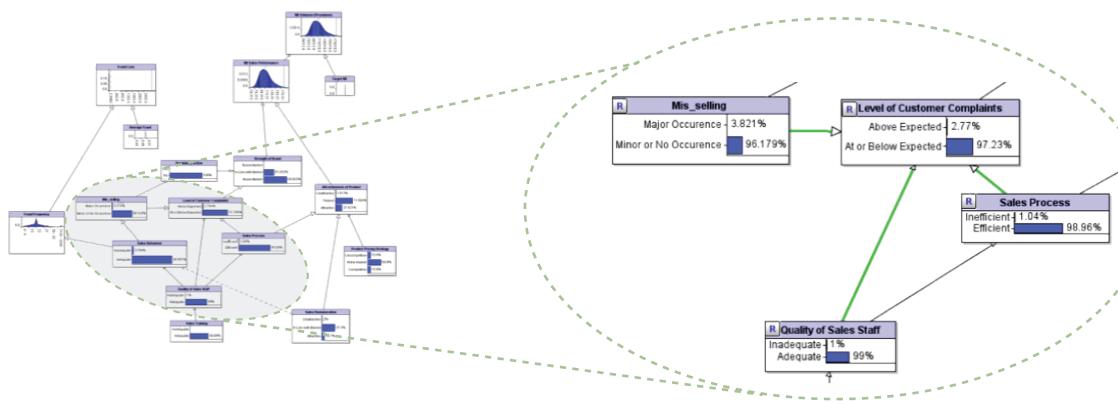
The outcome variables are typically modelled using continuous distributions. In the case study model, continuous probability distributions were used to model the forecasts in respect of both annual new business sales and the financial loss from fraudulent sales. In each case, the distributions were calibrated by conditioning the estimated outcome on the underlying causal drivers that are directly linked to that outcome. For example, as shown in Figure 31, the distribution for new business sales performance in the agency channel is conditional upon the *'Strength of the Brand'* and the *'Attractiveness of the Product.'*

FIGURE 31: CONTINUOUS NODE CALIBRATION
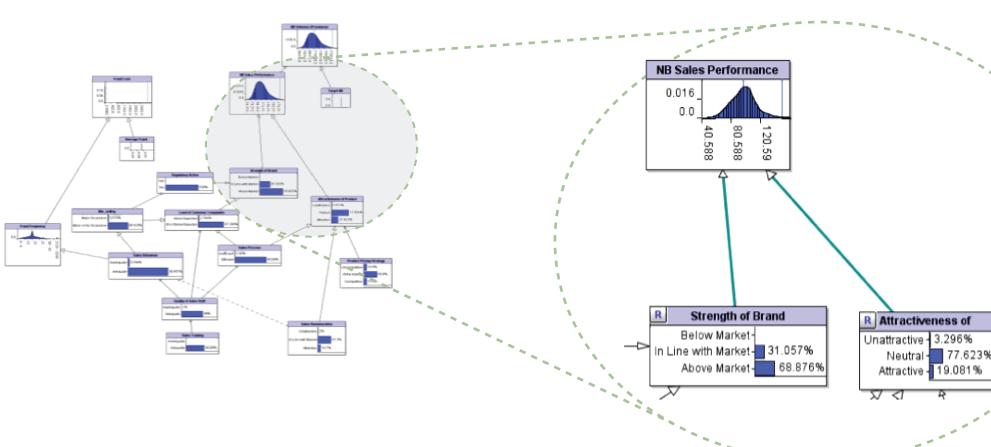
For each combination of states, e.g., *strong brand and unattractive product, strong brand and attractive product, etc.*, the business experts are asked to provide:

- A central estimate of the outcome they would expect to see most of the time in that scenario, for example:
  - *"With a strong brand and attractive product, annual new business sales should be 120% of plan."*

- An expression of the level of uncertainty around that central estimate, for example:
  - 5% if they are quite certain (suggesting that sales should be between 115% and 125% of plan).
  - 20% if they are much less certain (suggesting that sales could be anywhere between 100% and 140% of plan).

- A view as to the minimum or maximum value that the outcome variable could take, for example:
  - *"With a strong brand and attractive product, annual new business sales should never be lower than 75% of plan."*

This information is then used to parameterise an appropriate statistical distribution, in each case chosen to capture the expert's view of the 'shape' of uncertainty under those particular circumstances. For example, if a result either side of the central estimate is equally likely, then a normal distribution may be appropriate. However, if it is more likely that the actual outcome will fall on one of the sides of the estimate then a skewed distribution can be chosen.

The final, overall distribution for each outcome variable is a mixture distribution determined by combining the above state dependent distributions weighted by the probability of being in the corresponding combination of states.

To obtain this calibration input, the business experts from the case study firm were first sent a preliminary calibration questionnaire, shown in Figure 32. The initial calibration was then refined during a small number of follow-up model review workshops, during which the calibration was reviewed and challenged until the outcome distributions were sufficiently aligned with the expectations of the business experts.

FIGURE 32: SAMPLE CALIBRATION QUESTIONNAIRE

Ideally, the model should be calibrated by or with input from the same business experts involved in the initial discussions about the dynamics and drivers of the operational risk (see Section 4 above). This ensures that the view and understanding of the risk is consistent throughout the model development process.

It is also important to convey to the business experts involved that the model calibration is an iterative process, both when arriving at the first agreed calibration and when actively using the model on an on-going basis in the future.

8 MODEL USE

8.1 Overview

With input from the business, the case study model was subjected to high-level validation to ensure it exhibited realistic dynamics and was capable of forecasting credible outcomes. The model was then used to produce sample analysis for two different applications: 1) performance reporting, and 2) risk management. This section describes the case study experience in respect of each of these applications, and also explores how the model could potentially be used to enhance decision making as a third example application.

8.2 Reporting

The sample model developed for the case study produced two primary outputs:

1. A probability distribution for new business volumes over the 12 months following the calibration date, for each of the distinct distribution channels and the business as a whole.

2. A probability distribution for the total financial loss incurred as a direct result of fraudulent behaviour within the sales agent distribution channel over the same 12-month period.

In each case, the probability distributions were fully continuous and represented the complete range of possible outcomes. Furthermore, the distributions did not appear to conform to any standard or linear statistical distribution and were considered to much more closely reflect the actual 'shape' associated with possible outcomes.

In addition, because the different distributions were produced within the same causal model and shared common drivers, they responded consistently to changes in the calibration of the model. For example, an improvement in the expected 'quality' of sales staff immediately flowed through to lower expected losses from fraud and higher expected sales volumes, eliminating the need to consider such a change on one outcome variable in isolation from the other.

1. *Business performance reporting*

    The probability distributions for new business were used to provide a range of forecast statistics in relation to new business sales over the next 12 months, including:

    - Expected volume of new business measured in absolute terms (e.g., in New Taiwan dollars)
    - Expected volume of new business relative to planned or target levels
    - Probability that actual new business will succeed in meeting sales targets
    - Level of uncertainty associated with new business sales, i.e., stable or volatile

    The value of taking a causal approach to business forecasting is derived from having an explicit link between the variable of interest, in this case future new business volumes, and the underlying drivers which contribute to the actual outcome. In our sample model, these include not only the quality of sales staff and their levels of remuneration but also product pricing and customer service levels.

    Including information in relation to at least the key drivers (i.e., those which influence the top-level outcomes the most) alongside the forecast results provided additional insight into the reasons for these forecasts, thereby making the output more meaningful to a business audience.

    With respect to presenting this sort of information from the model, our recommended approach is to always work closely with the end users of the model output (e.g., department heads, senior management, Board members, etc.) to establish their information needs, and design the reporting around these specific requirements.

The highly visual manner in which Bayesian networks can now be constructed and interacted with means that a 'snapshot' of the model typically contains all the information necessary to gain a complete understanding of the forecast.

FIGURE 33: EXAMPLE MODEL SNAPSHOT
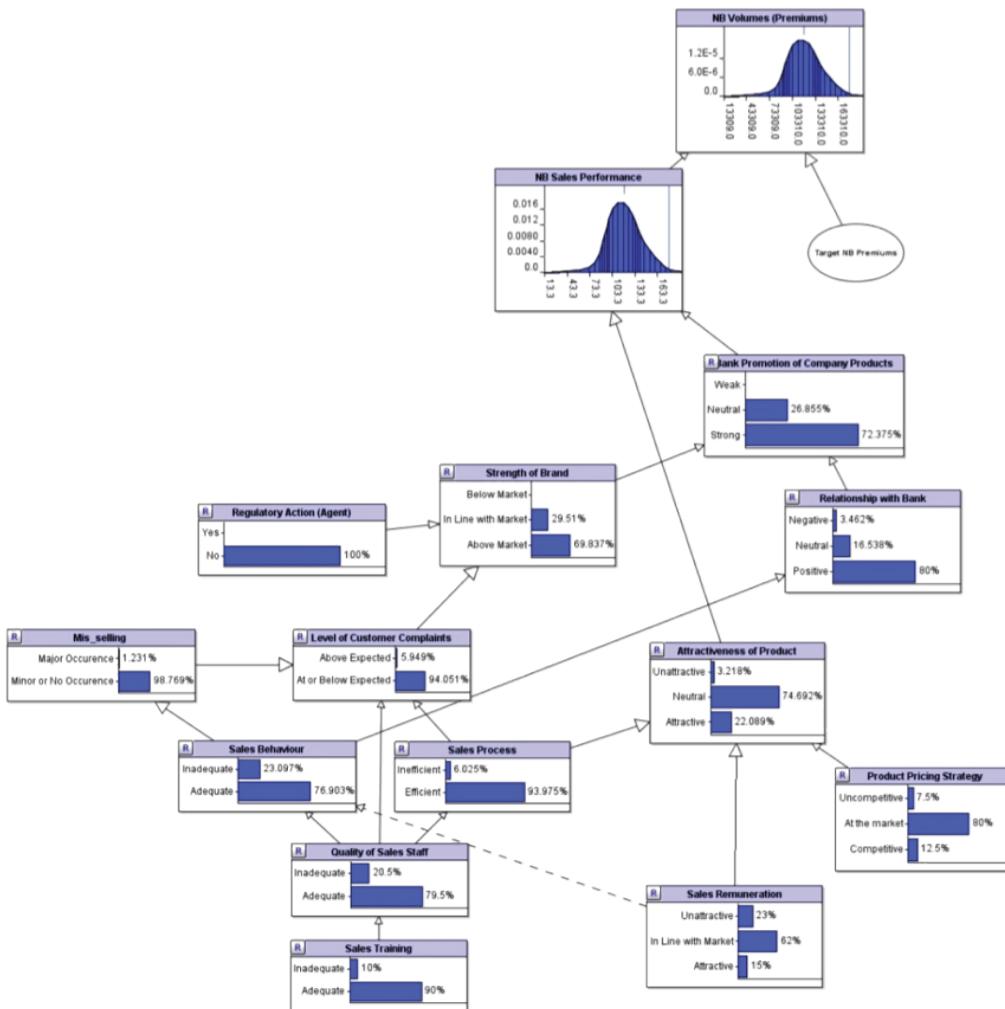
However, unless the users of the reporting are sufficiently well versed in the structure, calibration, and workings of the model, presenting the model output in this way is as likely to confuse as it is to inform. Presenting the model output in its entirety also makes it more challenging to highlight or focus on the most important elements of the forecast.

For the case study, we used an alternative approach whereby key summary statistics from the model output were presented alongside explanatory commentary. Presenting the model output within a visual dashboard framework offered a more immediate and engaging way of delivering the analysis.

An example dashboard based on the output from the case study model is shown in Figure 34.

FIGURE 34: EXAMPLE REPORTING DASHBOARD

	AGENT CHANNEL	BANK CHANNEL	AGGREGATE LEVEL
Current sales expectation (NT$ Bn)	550	400	950
Percentage of planned sales	97%	119%	108%

Probability of NB volumes being greater than annual target

Agency Channel Key Drivers

Bank Channel Key Drivers

Note: The figures in Figure 34 are for illustrative purposes only.

In the example provided in Figure 34, where a qualitative metric has been used such as 'product attractiveness,' it may also be useful to include other secondary drivers which can be matched against corresponding KRIs or KPIs.

Depending on the frequency with which forecasts are updated, presenting the current model output alongside previous sets of forecasts allows the case study firm to:

- Identify trends such as a gradually increasing probability that sales targets will not be met or a steady deterioration in expectations regarding the efficiency of the sales process.

- Provide a more transparent mechanism for explaining changes in the forecasts from period to period, e.g., change in model calibration, change in data inputs, etc.

- Improve its understanding of the level of volatility associated with the forecast itself, which over time should become more stable in line with increased use of KRI data to calibrate the model and more robust application of expert judgement.

The case study dashboard could be further enriched by including additional information, such as:

- Current performance data to indicate the extent to which the forecast differs from recent experience, and therefore whether new business sales are expected to improve or deteriorate relative to current levels.

- Industry forecasts (if available), to enable the firm to assess how it is expecting to perform relative to its competitors and the market as a whole.

For longer-term forecasts, for example if the firm's business planning period extends out further than 12 months, separate versions of the model in respect of each year of the business plan can be easily created by duplicating the original model. The fixed inputs and node calibrations within each model are then updated to reflect assumptions consistent with the corresponding stage of the business planning period. For example, forecasts for consecutive periods might be based on anticipated growth in the insurance market or year-on-year improvements in the effectiveness of the firm's internal sales training.

2. *Ex post analysis*

The inference property of Bayesian networks allows us to determine the states of the underlying driver nodes that are consistent with an observed result. Therefore, once the 12-month period which corresponds to the new business forecast had concluded, the model could be used to help explain to the business how and why the actual new business volumes were achieved.

This is done by applying a reverse 'stress,' in which the probability distribution for new business volumes is conditioned to lie within a close range of the actual result. The model is then resolved to show the position of the dependent factors that would lead to or cause the firm to achieve that result.

For example, the model suggested that missing the annual sales target by 10% was primarily caused by a combination of a less competitive pricing strategy and a significant deterioration in the efficiency of the sales process relative to expectations.

To the extent that the actual performance or state of the causal factors over the year can be validated, if this information differs from the results of the ex post analysis then this process also serves as an important feedback into the continued refinement of the model.

The probability distribution generated by the model can also be used to estimate the likelihood of the observed result. This allowed the firm to establish whether the actual sales result was in line with the central, best-estimate forecast, or in the tail of the distribution and therefore an outlier in terms of the expected level of sales.

In a reasonably steady-state environment, this information can now be used to inform the Board, senior management, etc., how likely it is that the business will achieve similar sales in the next period. For 'tail' results, the model can be used to validate any beliefs or judgements about why performance was so much better (or worse) than expected.

3. *Profit and balance sheet reporting*

The probability distributions for losses arising from fraudulent sales activity were used to provide a range of forecast statistics, including:

- Expected level of losses from sales fraud over a 12-month period at a given percentile
- Probability that losses from sales fraud will exceed a chosen threshold level
- Level of uncertainty associated with losses from sales fraud, i.e., stable or volatile

The case study model can therefore also be used in:

- *Provisioning*

  – The mean of the distribution can be used as the basis for setting up a contingency reserve to cover expected losses from fraudulent activity.

- *Setting operational risk capital*

  – The 99.5th percentile level of loss from the distribution, for example, can be used to set the capital required to cover loss from an extreme or 'tail' fraud event occurring over the next 12 months.

8.3 Risk management

As discussed previously, the case study model generates continuous probability distributions in respect of new business volumes (varying by channel) and losses due to fraudulent sales activity. We have also separately discussed how consideration of the mean and the 'tail' of the distribution can be used in business forecasting and risk capital setting respectively. By considering the outcomes expected at other probability levels, the model output can be used to inform both the setting and monitoring of individual risk limits.

For example, under the assumption that the state of the underlying risk drivers would remain stable, the 80th percentile from the loss distribution provided an indication of the minimum level of fraudulent sales that the business might expect to experience once every five years. If this is greater than the Board or senior management's tolerance for loss from this source over, say, the business planning period, then the model can be used to explore the means by which the business can be brought back within appetite. On the other hand, if the projected 1-in-5-year loss was lower than the corresponding risk limit, then the model can be similarly used to understand the potential ways in which the limit will be breached.

The case study model was used to perform a wide range of analytical tests that, if now implemented and presented carefully, have the potential to greatly improve the firm's existing risk management system. Sensitivity, scenario, and reverse stress testing are a common feature of many risk and financial models, but the ability of Bayesian network models to assess cause and effect within a consistent framework provides a unique opportunity to gain a much deeper understanding of operational uncertainty. The benefits and applications of each of these test classes is considered separately below.

▪ *Sensitivity testing*

— The case study model was used to identify how sensitive the primary output variables were to changes in each of the underlying driver variables.

In the example sensitivity analysis shown in Figure 35, the central bold line shows the expected volume of new business as a proportion of plan for the agency channel, e.g., 97%, given by the mean of our probability distribution. The blue bars then show how the mean of the distribution changes when each of the individual drivers are varied in turn. The longer the bar the more sensitive the mean is to changes in the corresponding driver.

FIGURE 35: EXAMPLE SENSITIVITY ANALYSIS
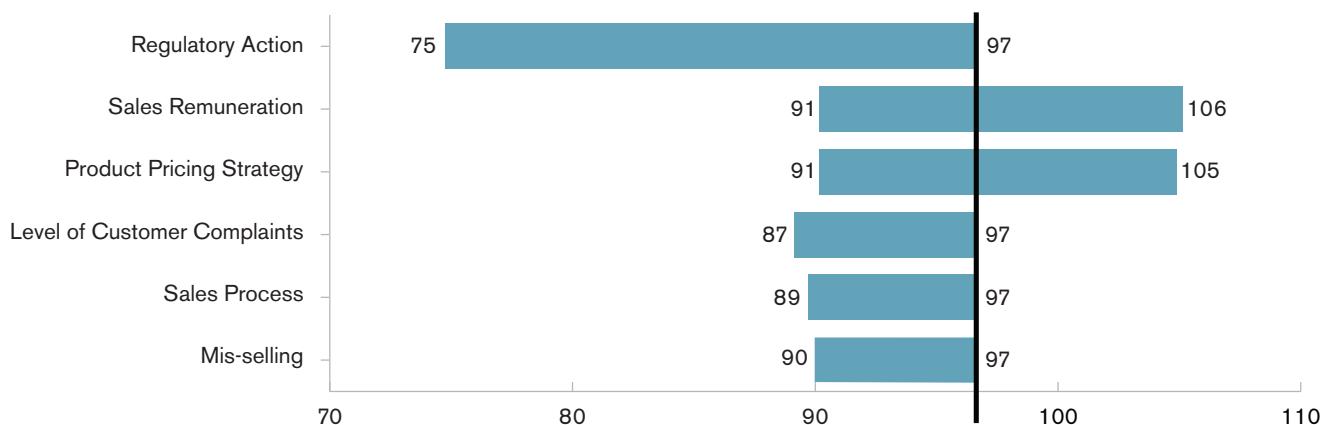
The results of the sensitivity analysis were used to understand and prioritise the areas of the model which are most important to validate and keep under regular review. This ensures that the model calibration is as robust as possible on an on-going basis.

The sensitivity analysis was also used to identify the operational areas of the new business generation process that the firm should be monitoring with KRI or KPI metrics. For firms where a KRI/KPI framework is already in place, the analysis can be used to streamline Board or committee level reporting so that management is able to focus on the chief drivers of uncertainty.

If the firm carries out the analysis on a regular, on-going basis, it may identify significant changes in the sensitivity of new business volumes to one or more of the modelled drivers. This may then be used to trigger investigative work into the current performance of the corresponding department, process, control, etc.

Lastly, the sensitivity analysis was used to inform which specific areas of the business could be targeted to most effectively or efficiently improve new business performance. In Figure 35, the results of the sensitivity analysis indicate that improvements to sales remuneration or the firm's pricing strategy are likely to yield a greater increase in expected sales compared with making changes to the sales process or customer complaints handling.

Similarly, if the firm wishes to strengthen the control environment to reduce the variability in new business sales or to limit the scope for sales to significantly fall below plan, then the model suggested that improving the risk mitigation around potential regulatory action may be the most effective approach.

- *Scenario testing*

  — Single and multifactor scenarios were constructed within the model by assigning 'observations' to one or more of the driver nodes. Observations are equivalent to assuming with certainty that the sales process will be inefficient over the next 12 months according to the company's internal standards.

  The model output provided valuable insight into the expected impact on future new business volumes from a change in the operational performance of the business, or the external environment.

  In any particular scenario, the modelled distributions may undergo a change in the level of uncertainty, a shift in the central expected outcome, or an overall change in the shape of the distribution, all of which provide useful insight into the dynamics of the business.

  In the example in Figure 36, the distribution for new business volumes for the bancassurance channel (as a percentage of planned levels) was presented in a box-plot format. The results of the base projection were then compared with the results corresponding to each of 1) a competitive pricing strategy, 2) attractive commission levels, and 3) an adequate level of sales training, and showed the projected impact on the mean level of sales as well as the degree of uncertainty expected and the scope for extreme positive (or negative) outcomes.

FIGURE 36: EXAMPLE SCENARIO ANALYSIS
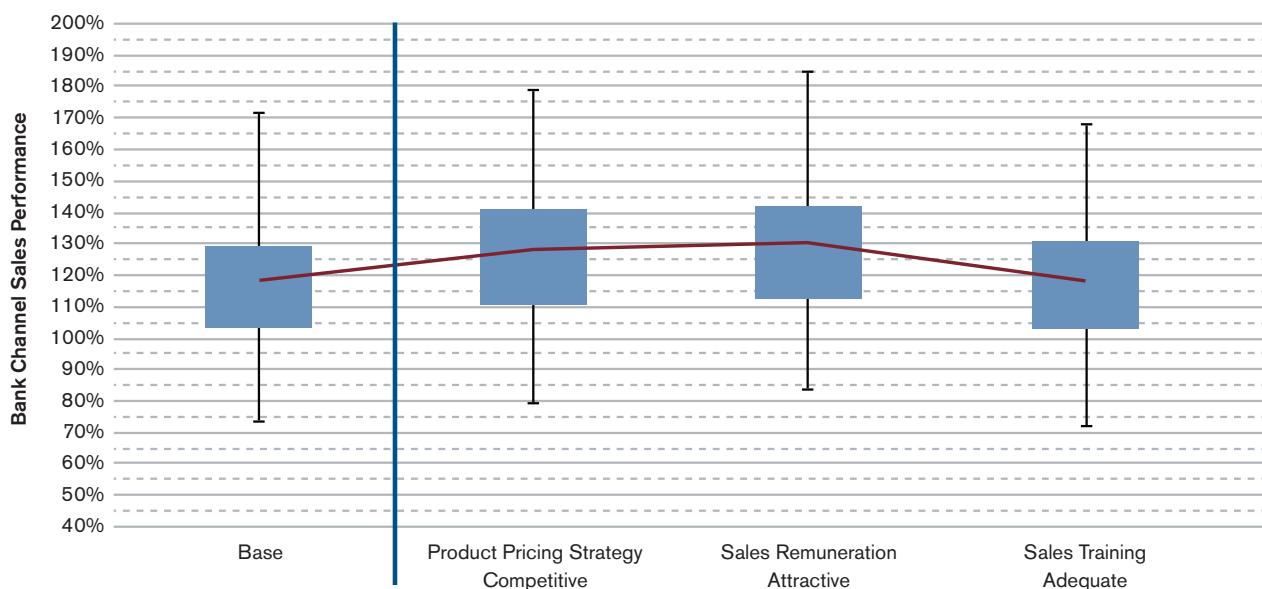
The model allows the business to assess the impact of alternative scenarios in a consistent, measurable way, some of which it would not normally be possible to directly quantify without a causal approach. And by choosing scenarios which represent circumstances that are meaningfully different from those suggested by the view of the business experts or implied by the calibration data, the model greatly enriches scenario planning and resilience testing.

- *Reverse stress testing*

  — The approach to scenario testing afforded by the model (described above) enabled the business to ask 'What if…' questions, such as *'What if the firm is subject to regulatory sanctions?'* To complement this 'bottom-up' analysis, the model also allowed the business to ask more outcome-focused questions, such as *'What could cause new business volumes to fall significantly below planned levels?'*

  This was achieved by applying 'top-down' reverse stress tests, in which the probability distribution for a particular outcome variable was conditioned to be above or below a specified level. The model then determined the state of the underlying driver nodes that were consistent with that range of outcomes.

  Reverse stress tests were calibrated at a range of severities to identify the circumstances consistent with anything from the breach of a soft risk limit right up to loss levels that could endanger the solvency of the firm.

8.4 Decision making

Models such as the one developed for the case study project can greatly enhance a firm's decision-making process, by providing richer and more credible justification for proceeding with or turning down a particular proposal. Some potential examples are set out below.

By demonstrating the anticipated reduction in operational risk capital, the model could be used to justify investment in the level or quality of training provided to new and existing sales staff. The model would also indicate whether the reduction in risk capital would arise from a reduction in the likelihood or frequency of sales fraud occurring, a decrease in the losses incurred by the firm if fraud does occur, or a combination of the two.

Similarly, the model may also highlight potential downsides associated with a particular project. For example, the model may indicate a large increase in expected sales fraud associated with a deterioration in sales behaviour following a reduction in remuneration levels, which would offset any costs saved from that reduction.

The model could also be used to illustrate any secondary benefits associated with a project. For example, a project to improve the ability of the firm to attract and retain high-performing sales staff, with the aim of increasing future new business volumes, could also be shown to reduce losses from fraudulent sales activity.

Furthermore, the model could be used to define constraints or hurdles which the proposed project must satisfy or pass to be approved. For example, an increase in the remuneration paid to sales staff must increase new business volumes by at least 5% and reduce sales fraud by 10%.

9 EXTENDING THE CASE STUDY

Within the boundaries of the exercise, the case study model developed for the partner firm offers a strong analytical platform for more reliable and dynamic forecasting, not only in relation to new business performance itself but also the potential losses arising from the pursuit of new business. The power of adopting a causal approach is that these forecasts are given much greater meaning by the explicit link made within the model between the outcome variables and the underlying operational risk drivers. The use of expert judgement together with relevant, recent indicator data also ensures that the model is calibrated on a forward-looking basis rather than purely in terms of past experience. As described within Section 8 above, considered use of the analytical techniques and outputs afforded by the model can therefore be used to implement significant improvements in reporting, decision making, and risk management.

Beginning with a model such as the one developed for the case study, which focuses on one particular area of operational uncertainty and a limited set of outcome variables, the techniques discussed in this research paper could be applied much more broadly to extend the coverage and scope of the framework. The following list presents some of the key ways in which the case study could be expanded.

- The case study model was developed in the context of an annual time frame, i.e., to cover the next 12 months from the point of calibration. Additional versions of the model that cover different time horizons, either more frequent (e.g., monthly or quarterly) or longer periods (e.g., the next five years) could be implemented to give the business a richer understanding of the drivers that effect operational performance over the short and medium term.

  It is important to note that constructing these models is not simply a case of adjusting any input variables or the calibration of certain nodes to be consistent with each time horizon. To ensure each model reliably replicates the key dynamics of the corresponding time period, it will be necessary to carefully review the constituent parts and the structure of the model framework. For example, certain drivers or dependencies may be much less (or, equally, much more) significant when considering time periods that are longer or shorter than a year. We have found that this is best achieved by repeating or at least expanding the early parts of the development process, i.e., the workshop discussions and cognitive mapping, to cover these different time periods.

- In line with the objectives of the pilot case study, the initial model for new business volumes has been structured and calibrated separately for the two main distribution channels used by the firm, i.e., sales agents and bancassurance. However, it would also be possible to develop models for each of the different product classes offered by the firm, especially if they are considered to have materially different operational risk profiles. For example, volumes on protection business may be more sensitive to the pricing strategy than to the firm's sales practices compared with unit-linked savings business. And may also be related to operational factors not covered by the current model structure, such as the degree of underwriting or the claims handling process.

  Similarly, where the firm operates in a number of different markets, it may be possible to use a comparable modelling structure in each geographic area but then calibrate the individual models to reflect the specific sales practices or external factors in those areas.

- The model can be expanded to cover other variables of interest that are partially or wholly dependent on the new business sales process. These might include directly related variables such as new business acquisition costs or marketing expenditures, or the drivers of revenue and capital that are more indirectly affected, including:

  — Future maintenance (or renewal) costs associated with the in-force book

  — Claims experience of new business written by the firm

  — Persistency of the new business written by the firm

- Further model development could be carried out to cover the complete operational risk profile of the business, by first building and calibrating subordinate models that cover each of the firm's distinct operational risk exposures, i.e., hardware failure, poor customer servicing, weak regulatory and legal compliance, inadequate financial/actuarial functions, etc., and then linking these sub-models together via the risk drivers that are common to multiple risk exposures.

Such a model would allow the firm to generate an overall probability distribution for the total operational losses expected to be incurred by the firm. This distribution can then be used to determine the aggregate operational risk capital needed for internal or regulatory balance sheet reporting.

This approach to operational risk capital ensures that different exposures or scenarios are treated consistently and that dependencies between different operational functions or parts of the external environment are sufficiently and realistically captured.

The resulting model permits not only more holistic scenario analysis, for example assessing the wider impact that increased mis-selling activity has on the business as a whole, but also more scope to rank the individual operational risk exposures and therefore more effectively target control improvements on the areas which could either do the most damage or which are subject to the greatest level of uncertainty.

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