DEVELOPING THE RISK APPETITE FRAMEWORK OF A LIFE INSURANCE BUSINESS

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1 INTRODUCTION

1.1 Purpose of Paper

It is important for businesses to have a well-articulated Risk Appetite Framework to ensure they have considered the risks associated with their business plans, and have the resources to mitigate these risks should they arise.

The Life Insurance Risk Appetite Working Party has written this paper to give practical assistance to a life insurance business operating in Australia in developing or reviewing its Risk Appetite Framework. It is a guide to possible approaches and is not meant to be prescriptive.

There are comparatively few papers on this topic, which specifically cover the insurance industry. This paper gives both a general background to setting a Risk Appetite Framework within an institution's Risk Management Framework, as well as specific life insurance examples for Risk Tolerances and Risk Limits.

The paper is set within the context of APRA's regulatory framework in Australia.

We acknowledge the wide range of life insurance businesses operating in Australia which vary by size and complexity etc. No one approach will fit all and we recognise this where possible in the paper. We also recognise that best practice in relation to risk management and risk appetite is an area that is constantly developing and evolving and it is our hope that this paper is an aid to that development.

The authors acknowledge the substantial body of work carried out in relation to risk appetite. We have selected from that material, and have added some suggestions based on our experience and ideas.

1.2 Historical Context

It is worthwhile to consider the context of risk appetite (and the risk reward trade-off) more generally before applying it directly to life insurance.

The linked concepts of risk *aversion*, risk *tolerance* and risk *appetite* are probably as old as man. Prehistoric man presumably needed to assess their own appetite for food against the risk of being supper for a sabre tooth tiger.

Quick on the heels of the scientific measurement of probability in the 1600's came the realisation that most people (most of the time) were unwilling to participate in even money bets – that is they are risk averse. That is, outside the realm of gambling people would *prefer* a certain payoff of – say - $5,000 a week in salary against a commission of between $0 and $10,000 with an expected commission of $5,000.

This very rational approach to investing is an example of *utility theory* – an economic concept codified in 1947 that postulates:

- Humans are rational agents; and hence
- They are utility maximising – in that they seek to behave in a way that will maximise their *expected* utility. This introduces the concept of choice and uncertain outcomes (which will eventually morph into business strategies and risk);

- They are risk averse – they prefer a certain outcome with equivalent payoff to an uncertain outcome with the same expected payoff.

Within the realm of finance the work of Harry Markowitz in 1952 established a framework to consider the risk / reward trade-off in the context of investment portfolio construction. He advocated that rational beings should invest where the benefit of more risky investments (increased expected return from bearing risk) was consistent with the investor's tolerance for bearing that additional risk.

Since the 1970s research (under the general topic of Prospect Theory) has shown that this is not the case – normal people fail the tests that define a 'rational agent'.

- Normal people's risk preferences vary depending on the way the risk / reward options are presented;
- Normal people are not always risk averse; and
- Normal people are not particularly good at assessing the probabilities associated with uncertain outcomes – they have certain persistent biases that distort decision-making.

For example, traders on a trading desk (or underwriters in an insurance company) may overestimate their ability based on a small number of recent successes (an "availability bias") and exceed trading limits. Should this trader lose money they may take trading positions with increasingly negative expected payoffs. That is, they are "risk seeking in the realm of losses" – they bet the farm on an outside horse at the races because they have nothing to lose.

From this historical context we would conclude:

- Establishing a risk appetite is *hard* – Boards should be rational in establishing a Risk Appetite but the normal people who comprise Boards may not be;
- Establishing a risk appetite is *important* – appetite must be set at the top and then cascaded down via effective tolerances and limits;
- Risk appetite should be *set in the context of the expected reward for risk taking* – in a company context the profits arising from the business plans and strategies.

1.3 Risk Appetite in Enterprise Risk Management

Risk appetite has been part of the Enterprise Risk Management (ERM) movement since its emergence in the 1990's – though as more of a bit player than a star performer. In 1996 Jerry Miccolis and Tim Quinn penned a paper 'What is your appetite for risk?' in the magazine 'Risk Management'. However, a 2003 paper by the US Casualty Actuarial Society on ERM failed to mention the topic at all. Text books on ERM published in 2003 also gave the area little attention.

In public finance risk appetite gained greater credibility earlier. In the UK the 'Orange Book' – published by the British Treasury in 2001 and titled 'Management of Risk, a Strategic Overview' – included a reference to risk appetite in the modern context. It recognised that the firm's willingness to accept risk should drive risk mitigation strategies.

By 2006 the concept of risk appetite (or risk tolerance - the two were used interchangeably) was beginning to find its way into insurance and risk vernacular. Early text books in the CERA course of reading used the concept. In October 2007

the IAIS issued its "Guidance Paper on Enterprise Risk Management for Capital Adequacy and Solvency Purposes" which first introduced the concept in a regulatory setting.

The Global Financial Crisis was the catalyst for an additional focus on risk appetite. In 2011 the FSB commented that *effective* risk appetite frameworks were not prevalent in financial institutions[1]. The IAIS meanwhile had morphed a Key Feature of its guidance note into its Insurance Core Principle 8 on Risk Management and Internal Controls.

In November 2013 the FSB finalised its "Principles for An Effective Risk Appetite Framework" on which this paper leans for guidance and definitions.

In December 2013, the North American CRO Council and the generally European based CRO Forum issued in the paper "Establishing and Embedding Risk Appetite; Practitioners' View" 'a variety of sound practices that can enable an organisation to create an effective risk appetite framework' for the insurance industry.

1.4 APRA's expectations in CPS 220

APRA has responded to emerging requirements in banking and insurance through CPS 220.

APRA's requirements in respect of risk appetite as set out in CPS 220 are:

- Paragraph 13 (a) requires the Board to define an institutions risk appetite as a part of its Risk Management Framework. This is reinforced in paragraph 25(a);
- Paragraphs 13 (c), (e) and (h) requires senior management to develop policies, controls and to monitor all material risks consistent with, inter alia, the Risk Appetite Statement;
- Paragraphs 29 and 30 deal directly with risk appetite. Paragraph 29 requires the institution to maintain an '*appropriate, clear and concise risk appetite statement that addresses its material risks*'.
- Paragraph 30 sets out the minimum requirements of a risk appetite statement. It is reproduced verbatim below (additional bold text has been added by the authors of this Paper);
- Paragraph 47 (a) requires that a formal review consider whether the Risk Management Framework is consistent with the Board's risk appetite;
- Paragraph 52(a) requires that the Risk Appetite Statement be provided to APRA on first adoption and after material revisions.

APRA sets out the key requirements involved in the documentation and governance of the Risk Appetite Statement (RAS) in paragraph 30, set out below.

[1] http://www.financialstabilityboard.org/publications/r_131118.htm

Figure 1: Key APRA requirements in the documentation and governance of the RAS

CPS 220: Paragraph 30

"30. An APRA-regulated institution's risk appetite statement must, at a minimum, convey:

a) the degree of risk that the institution is prepared to accept in pursuit of its strategic objectives and business plan, giving consideration to the interests of depositors and/or policyholders (**risk appetite**);
b) for each material risk, the maximum level of risk that the institution is willing to operate within, expressed as a risk limit and based on its risk appetite, risk profile and capital strength (**risk tolerance**);
c) the process for ensuring that risk tolerances are set at an appropriate level, based on an estimate of the impact in the event that a risk tolerance is breached, and the likelihood that each material risk is realised;
d) the process for monitoring compliance with each risk tolerance and for taking appropriate action in the event that it is breached; and
e) the timing and process for review of the risk appetite and risk tolerances."

APRA requires the RAS to document the institution's broad risk appetite (as defined by the Board), the risk tolerances to specific material risks, and the governance for setting monitoring and reviewing risk tolerance.

1.5 Structure of this Paper

The paper has two parts to it.

The first part (Sections 2 to 5) discusses the anatomy of a Risk Appetite Framework and sets out some criteria that can be used to assess the various components of a framework. The second part (Sections 6, 7 and 8) discuss the steps required to implement the framework.

Section 2 introduces the various components of the Risk Appetite Framework and defines the terms used in this paper.

Section 3 considers the risks facing a life insurance company.

Section 4 sets out considerations for establishing and maintaining an effective *Risk Appetite Statement*.

Section 5 – discusses Risk Tolerances and Risk Limits and how these two key items concepts relate to each other.

Section 6 – discusses possible approaches for use when calculating and cascading Risk Tolerances to Risk Limits.

Section 7 – discusses a possible approach for use when setting a Risk Appetite Framework.

Section 8 – discusses how to embed risk appetite within the broader risk framework.

1.6 Acknowledgements

The Risk Management Practice Committee, along with the Chair of the Life Insurance Risk Appetite Working Party, would like to thank all of those who have generously given their time and experience in either contributing to or reviewing this Paper. In particular, the authors would like to thank the members of the Risk Management Practice Committee and the Life Insurance and Wealth Management Practice Committee who reviewed a draft of this Paper and provided valuable and constructive feedback.

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2 THE RISK APPETITE FRAMEWORK

One of the requirements of APRA's Prudential Standard CPS 220 is that an APRA-regulated institution must maintain a Board-approved Risk Appetite. In addition the institution must maintain an appropriate, clear and concise Risk Appetite Statement that addresses its material risks.

In this Paper the definitions for key risk appetite terms quoted in Sections 2 were chosen after considering the definitions used by APRA and key international organisations.

We have tended to opt for the definitions advocated by the **Financial Standards Board (FSB)**[2] where they have been considered to be appropriate. The FSB's paper on the *Principles for an Effective Risk Appetite Framework* is relatively recent (November 2013).

We also considered definitions recently proposed by the **CRO Forum** and the **North American CRO Council**[3].

Further information regarding the approach adopted in determining the following definitions along with information regarding the key international bodies mentioned above can be found in Appendix A.1.

2.1 Principles

As a life insurer progresses through the process to develop, establish and use their Risk Appetite Framework, it needs to be conscious of certain guiding principles to ensure the framework is appropriate and effective. These principles are informed by the FSB's publication "Principles for An Effective Risk Appetite Framework".

These guiding principles can be articulated as:

- Risk appetite should be built on an understanding of the organisation's risk capacity and strategic direction.
- Risk appetite should be integrated with the development of organisational strategy and business plans.
- Risk appetite should be clear enough for Board and management to use in the development of business planning.
- Risk appetite should be able to be communicated easily and effectively to all layers of the organisation and externally.
- Risk appetite should be integrated with the risk culture of the organisation.
- Risk appetite should explicitly define the boundaries for risk taking in pursuit of strategy at organisational, individual business and risk type levels.
- Risk appetite should be congruent both top-down and bottom-up and within a legal entity and a wider corporate group.
- The Risk Appetite Framework should be an integral part of the Risk Management Framework.
- Risk appetite should consider all material risks both in normal and stressed conditions.

[2] "Principles for An Effective Risk Appetite Framework", FSB 18 November 2013
[3] "Establishing and Embedding Risk appetite: Practitioners' View", CRO Forum December 2013

- Risk appetite should be monitored with sufficient frequency and efficiency to enable timely decision making in response to changes in the organisation's risk profile.

2.2 Risk Appetite Framework

The Risk Appetite Framework (RAF) describes the overall approach, including policies, processes, controls, and systems through which Risk Appetite is established, communicated, and monitored. The RAF should consider material risks to the financial institution, as well as to the institution's reputation vis-à-vis policyholders, depositors, investors and customers. The RAF should align with the institution's strategy. An appropriate RAF should also enable Risk Appetite, Risk Tolerances, Risk Limits and Risk Profile to be considered at the legal entity level as well as within the group context.

Definition 1: Risk Appetite Framework

"The framework describes the overall approach (including policies and processes) through which Risk Appetite is established, communicated and adherence to the institution's Risk Appetite is monitored."

The Risk Appetite Framework should incorporate the following elements:

- A Risk Appetite Statement;
- Tolerances and/or Limits on the activities of the insurer designed to ensure that they operate within the Board-approved Risk Appetite;
- A process for ensuring that the tolerances and limits are set at an appropriate level given the appetite for risk set out in the Risk Appetite Statement;
- A reporting structure against the limits and tolerances;
- An outline of the roles and responsibilities of those overseeing the implementation and monitoring of the RAF;
- A method of cascading the limits and tolerances, where appropriate, down to business units while ensuring that they remain appropriate in aggregate; and
- A governance framework to ensure the ongoing integrity of the framework.

2.3 Risk Appetite

Definition 2: Risk Appetite

"The aggregate level and types of risk an institution is willing to assume, or avoid, within its Risk Capacity to achieve its strategic objectives and business plan."

2.4 Risk Appetite Statement

The Risk Appetite Statement should, at the very least, articulate in writing the Board's willingness to accept risk in the pursuit of its corporate goals and objectives.

Definition 3: Risk Appetite Statement

"The articulation in written form of the aggregate level and types of risk that a firm is willing to accept, or to avoid, in order to achieve its business objectives. It includes qualitative statements as well as quantitative measures expressed relative to earnings, capital, risk measures, liquidity and other relevant measures as appropriate. It should also address more difficult to quantify risks such as reputation and money laundering, as well as business ethics and conduct."

Risk Appetite Statements are dealt with in greater detail later in this Paper.

2.5 Risk Capacity

If we consider Risk Appetite as the institution's willingness to accept risk (in the context of achieving its business objectives), then Risk Capacity can be viewed as an absolute maximum on risk taking imposed from outside the organisation i.e. it is an exogenous constraint determined by such factors as Regulatory Capital.

Definition 4: Risk Capacity

"Risk Capacity is the maximum level of and type of risk an organisation is able to support before breaching constraints determined by regulatory capital and liquidity needs and its obligations to customers, shareholders and other stakeholders."

2.6 Risk Tolerances and Risk Limits

Risk Tolerances articulate the boundaries for the maximum amount of risk that an institution is prepared to accept. A tolerance sets out the overall quantitative and/or qualitative boundaries for a material category of risk. It is often expressed in the form of key metrics and targets, and is established after considering how much variability and risk-taking is acceptable in the pursuit of achieving strategic objectives. It is often described as the 'line in the sand' beyond which an organisation will not move without prior Board approval. Another way to view tolerances is that they are a constraint on business outputs.

Definition 5: Risk Tolerances

"Risk Tolerances are the quantitative measures and qualitative assertions for the maximum risk allowed by the appetite. Risk tolerances are typically set at the enterprise level."

Risk Limits are operational in nature and serve to translate the Risk Tolerances (contained in the RAS) into practical constraints on business activities. In this sense they could be viewed as being constraints on business inputs. They are threshold controls designed to ensure that variation from expected outcomes will not exceed an institution's Risk Appetite. Effectively applied, Risk Limits are the manner in which Management gives effect to the Board's Risk Appetite, by curtailing activities that would contravene the overall Risk Appetite. Examples include:

- Restriction on the amount of equity exposure an institution can take on in pursuit of its strategies;
- Limits on the maximum sum insured per life; and
- Minimum prescribed reinsurance purchases against catastrophic risks.

Definition 6: Risk Limits

"The restrictions prescribed by an institution on its business activities, designed to constrain overall risk taking within the Risk Tolerances established in the Risk Appetite Statement. Risk Limits are operational in nature and serve to cascade the Risk Tolerances (contained in the Risk Appetite Statement) into practical constraints on business activities."

Risk Limits often relate to a subsection of the enterprise – such as business division or 'material risk'.

They are 'no go zones' – in effect, the way that a Board can progress from 'we don't want this to happen (Risk Appetite) to 'you can't do that'. Conversely, the enterprise should have a Risk Appetite that takes enough risk to meet the objectives of its shareholders.

In order to facilitate effective monitoring and reporting Risk Limits should at the very least be specific, testable and reportable. Risk Limits should also be tested to ensure they are effective in controlling Risk Tolerances.

2.7 Risk Profile

Risk Profile can be seen as a snap-shot of where an organisation sits at a given time on the risk spectrum.

Definition 7: Risk Profile

"A point in time assessment of risk exposures, expressed in relation to Risk Limits, Risk Tolerances and Risk Capacity."

2.8 A Reporting Structure for Risk Limits and Risk Tolerances

Monitoring performance and risk exposures against Board-approved Risk Tolerances and Limits presents its own challenges.

Chief amongst them is the issue of sovereignty – should the risk owner report on a material risk or should it be centralised by the CRO? Most would argue that a risk profile goes across multiple risk types and needs to be presented holistically. If risks are not managed holistically, then interactions between risks may not be properly assessed. However, if this is the approach adopted, it is important that ownership of the risk remains with the appropriate person.

Another challenge deals with diversification (or aggregation) benefits. Even with so-called tail events (e.g. Black Swan events) there are some aggregation effects and Risk Limits should be set giving some benefit to these. How should diversification benefits be reflected in reporting? Either:

- The aggregation benefit is 'allocated' to each risk measure (a near arbitrary and always opaque exercise); or
- It is identified separately – leaving a potentially significant contributor to risk without a natural 'owner'.

Each Board will deal with this in its own manner.

2.9 Integrating Risk Appetite into the broader Risk Management Framework

One would expect that a Risk Appetite would be a rather central part of any Risk Management Framework. After all, what use is it to identify a risk if we have no framework to determine if we want it or not?

Risk appetite is an early part of any risk management process. After identification, assessment is against a question 'how much of this risk are we willing to bear'.

A formal Risk Appetite Statement allows this question to be addressed in a consistent manner, and facilitates cascading the appetite throughout the organisation.

2.10 A Governance Framework to ensure the ongoing integrity of the RAF

The FSB wants the **Board** to approve the Risk Appetite Statement – and we agree. However we would argue that this is one area where Board involvement in the *development* of the Risk Appetite Framework is essential. We don't believe that a paper drafted in isolation then sent to the Board for approval will be meaningful. By their nature the Risk Tolerances should lie on the boundary of what is acceptable to the Board – and the Board must be consulted early on in the piece to ensure they approve a document that reflects their combined appetite for risk.

Other key stakeholders are the **risk owners**[4] – the officers within the company responsible for managing each material risk. Risk Limits are imposed on risk owners in

[4] Who exactly the 'risk owner' is will vary by organisation. Where a risk is centralised, e.g. where the investment across all lines and divisions is managed by an in-house asset management function, the risk owner would be the Chief Investment Officer.

the pursuit of profit / bonus. (For example, the Chief Investment Officer often has responsibility for implementing any market risk positioning.) Risk owners should be engaged early to ensure that any Risk Limits:

- are easily understood (i.e. uses the language the manager uses everyday in communicating with their staff);
- Make sense (that is, they are meaningful, relevant and consistent); and
- Are measurable. Arguments about how to calculate a specific Risk Limit should not be conducted in front of the Board!

One approach to this is for the relevant risk owner and CRO to jointly propose Risk Limits to the Board in a paper that addresses strategy, performance targets and limits for that particular risk.

2.11 How should the Risk Appetite be cascaded down?

This Paper deals primarily with the task of establishing a Board-approved Risk Appetite and giving force to that appetite via carefully constructed tolerances and limits for key material risks. It deals with the obligations of the Board in relation to this. Once established, the appetite must be cascaded throughout the organisation.

A call centre operator with the authority (and training) to exercise discretion to spend money to deal with customer complaints can generate much goodwill and return custom for a firm. The risk / return trade-off that call centre operators choose is a microcosm of the decisions made by the board.

We see two separate but related areas:

- The requirement that the risk exposures actually borne by the firm remain within the appetite, by limiting the exposure and activities via Risk Limits; and
- Encouraging a culture that adopts a systematic way to assessing risk-taking further down the organisation – weighing the individual propensity of managers and others to bear risk against the collective firm's willingness and capacity to bear risk.

The further down the organisation can cascade appropriate risk-taking the greater the potential gain – think about the call centre operator. However, risk-taking implies the exercise of discretion and there must be limits (consistent with the Board-approved appetite) on that discretion.

Where a firm operates separate operating entities by distribution channel of geographic region the owner is most likely the CEO of the operating entity.

3 RISKS FACING LIFE INSURERS

3.1 Sources of Risk

In order for a Risk Appetite Framework to be executable and effective, consideration must be given to specific sources of risk. Underpinning any Risk Appetite Statement and framework is the recognition that adverse outcomes are possible. Without proper identification of the sources of these outcomes, the risk framework may be ambiguous and of little practical value to the organisation.

Categorisation of risks into discrete types allows practical procedures to be developed for the risks to be assessed, monitored and reported.

The spectrum of risks facing life insurers may generally be categorised into the following risk types (using the APRA groupings in CPS 220.28):

- **Market Risk:** the risk arising from all aspects of the value of investments and currencies, including interest rate changes, market price changes, counterparty default, and exchange rates.
- **Credit Risk**: the risk of loss arising from failure to collect funds from creditors, including reinsurers and intermediaries.
- **Liquidity Risk:** is the risk that a company may be unable to meet short term financial demands. This usually occurs due to the inability to convert a security or hard asset to cash without a loss of capital and/or income in the process.
- **Insurance Risk:** The risk of loss due to actual experience being different than that assumed when an insurance product was designed and priced.
- **Operational Risk**: the risk of loss resulting from inadequate or failed internal processes and systems and the risk resulting from the loss of a company's human capital.
- **Strategic Risk:** the risk arising from the company's strategic objectives and business plans.

In some cases, certain risks may be classified under several categories. For example, aspects of Market Risk related to counterparty default may be considered as part of Credit Risk instead. In relation to Operational Risk, it is important to recognise that the above definition is very broad and as a result may overlap with other risks unless defined more clearly. For example, any failures which may occur in the claims processes could be defined as part of Insurance Risk or Operational Risk. In this event the associated events could be excluded from Operational Risk to avoid double counting.

3.2 Measurement/Modelling Approaches

The maturity of modelling techniques available to measure the above risks varies greatly between well developed and emerging risks . For example, there are well established and generally accepted modelling techniques to measure Market and Credit risks. The measurement of Operational Risk however is still an emerging area with a variety of approaches, some of which are largely qualitative. The potential impact of Insurance Risk can be modelled with stress and scenario testing based on the life insurer's portfolio and best estimate assumptions.

Even where well established modelling techniques exist to measure a particular risk, levels of sophistication adopted by individual insurers can vary greatly due to factors such as availability of data, access to proprietary modelling software and technical knowhow and the setting of best estimate experience assumptions and stress scenarios.

3.3 Risk Dependence

Once individual risks have been measured, they must be aggregated in order to produce a view of the organisation's overall risk profile. This poses significant challenges. It is intuitively clear that adverse outcomes in one risk do not always coincide with adverse outcomes in another risk, which results in a degree of diversification between risks. In establishing the level of diversification between risks, it is more practical to focus on dependence, which is the opposite of diversification, and consider the particular drivers of dependence between individual risk pairs. Dependence between different risk categories (such as Insurance and Operational Risk) may vary significantly between organisations, depending on their individual circumstances. Dependence assumptions used in modelling are difficult to base to any reasonable extent on observable data, therefore, qualitative methods are most commonly used to identify drivers of dependence and assign levels of statistical correlation.

One of the key challenges in making assumptions on dependence between risks is identifying a combination of risks that may experience "tail dependence", where there is a relatively high likelihood for extremely adverse outcomes to coincide. An example of this may be significant market losses at the same time as reduced new business sales, deteriorating claims and discontinuance experience impacting the business.

3.4 Model Limitations

All models used to inform the Risk Appetite Framework must be understood to have limitations. A model is only an approximation of reality and the nature of probabilistic models used to inform risk decisions is that the estimated probabilities of adverse events, especially those in the tail scenarios, can be highly uncertain.

3.5 Key Considerations by Risk

The range and materiality of risks for life insurers will vary by institution and depend on the asset and the liability profile of the life insurer. Insurance Risk is the major risk category for many life insurers. For life insurance companies that have significant long term guarantees inherent in their products, Market and Investment Risk, Credit and Liquidity Risk may be significant depending on the asset profile. Similar to any company, life insurers face Operational and Strategic risks. The following sets out the key considerations for each type of major risk facing life insurers today.

- **Market and Investment Risk**
    - Can be a significant risk for life insurers depending on the asset liability profile of the insurer including any long term guarantees inherent in products.

- Well-developed modelling techniques including stochastic modelling exist, but the extent to which these are employed can vary greatly across industry with some insurers using simpler approaches.
- Asset Liability risks may be categorised under Market Risks or Liquidity Risks. Asset Liability mismatching considerations are important for most life insurers, especially those with participating business and other guaranteed liabilities.

- **Credit Risk**
  - Depending on the business mix and the credit risk of the asset profile, Credit Risk may be a significant risk for some life insurers.
  - Credit quality of the reinsurance counterparties is an important consideration for life insurers given the long term nature of the liabilities reinsured.
  - Well established modelling techniques for credit transition exist but rely on uncertain estimates of default and credit transition probabilities.
- **Liquidity Risk**
  - It is important to consider Liquidity Risk even if only qualitatively.
  - This may arise in the case of outflows such as surrender payments exceeding premium inflows.
  - Management of Liquidity Risk should include life insurers holding enough liquid assets such as cash to meet the expected cashflow needs and be able to liquidate sufficient additional assets without significant losses to meet cashflow needs under certain stress scenarios.
- **Insurance Risk**
  - Insurance Risk is the major risk category for many life insurers.
  - Insurance Risk is a broad category and there are many types of risk included. These would include mortality, morbidity (covering TPD and IP), trauma, discontinuances, expenses, catastrophe and pandemic.
  - There are limited "off the shelf" models for assessing the level of Insurance Risk in a life insurance company and scenarios need to be developed based on the life insurance company's data and portfolio.
  - Assessing the interaction of the various types of Insurance Risk is complex and there are a number of interactions.
  - Stress testing can be used to inform the potential level of risks.
  - The general level of understanding of Insurance Risk and how product features or economic factors such as unemployment drive claims experience may not be understood by all stakeholders.
- **Operational Risk**
  - Operational Risk for a life insurer is another broad category of risk covering many aspects of the life insurer's operations including administration, unit pricing, data, regulatory and human capital risks.
  - There are many operational risks facing life insurers particularly for those with aging books of business, legacy information technology systems and the pace of regulatory change.
  - Measurement/modelling knowhow is relatively underdeveloped and as such less scientific approaches have been adopted than for other risk categories. Approaches range from completely qualitative through

to moderately sophisticated statistical loss models, to sophisticated Bayesian techniques.
    - Regulatory risk focus is generally a very high priority for life insurers.
- **Strategic Risk**
    - Impacts on profitability and capital can be considered using stress tests, otherwise strategic risks may be difficult to quantify.
    - Many life insurance companies have a range of distribution channels. Changes to these channels over time including the risks of advice given in relation to life insurance products may be considered as strategic risks.
    - The implementation of major systems or other projects may present a strategic risk to the business.
    - Reputational risk can be a significant risk for a life insurer. Reputational risk is often highly correlated to other risks and as such may be modelled/included under other risk categories. For example a significant operational failure or poor advice being provided in respect of the sale of life insurance products will have associated impacts on the organisation's reputation and flow on impact to franchise value. The reputation risk in these situations is likely to be included under Operational Risk.

4 THE RISK APPETITE STATEMENT

4.1 Introduction

The Risk Appetite Statement (RAS) is a key document that articulates the Board's appetite for risk and which influences the whole institution's approach to taking on and managing risk.

This Paper only considers the Risk Appetite Statement for single entity institutions. There are various ways to permeate a RAS set up at a group level company to legal entity or business level.

4.2 Risk Appetite Statement Definition

The Risk Appetite Statement has been defined for this Paper as:

Definition 3: Risk Appetite Statement

The articulation in written form of the aggregate level and types of risk that a firm is willing to accept, or to avoid, in order to achieve its business objectives. It includes qualitative statements as well as quantitative measures expressed relative to earnings, capital, risk measures, liquidity and other relevant measures as appropriate. It should also address more difficult to quantify risks such as reputation and money laundering as well as business ethics and conduct.

The Risk Appetite Statement should, at the very least, articulate in writing the Board's willingness to accept risk in the pursuit of its strategic objectives.

CPS 220 (specifically paragraphs 29 and 30) sets out APRA's expectations for what a Risk Appetite Statement, at a minimum, should contain. The similarities between this minimum and the definition above are evident.

Paragraph 30 states that the Risk Appetite Statement should convey:

- "the degree of risk that the institution is prepared to accept in pursuit of its strategic objectives and business plan, giving consideration to the interests of depositors and/or policyholders "; and
- "for each material risk, the maximum level of risk that the institution is willing to operate within, expressed as a risk limit and based on its risk appetite, risk profile and capital strength."

APRA's intention is for the Risk Appetite Statement to be a truly "Board-owned" document. It is the Board's responsibility to define, establish and approve an organisation's Risk Appetite (CPS 220 paragraphs 13a and 29).

The Board's strategic and business decisions need to be consistent with the Risk Appetite it has framed. Therefore the Risk Appetite Statement should be directly linked to the firm's strategy. It is also therefore important that the level of risk taken on by an organisation is consistent with and sufficient to meet the strategic goals as per the business plan. A good Risk Appetite Statement might therefore also include

commentary regarding what actions should be taken if insufficient risk is being accepted to meet the strategic objectives.

4.3 Stakeholders

In setting the Risk Appetite Statement, the Board should consider the institution's stakeholders and their expectations. The Risk Appetite Statement needs to be understood by all stakeholders, particularly by the Board, and it must be readily cascaded down to all levels of the organisation.

The key stakeholders[5], other than the Board, and their interests in the Risk Appetite Statement are shown below.

Figure 2: Key stakeholders in the Risk Appetite Statement

Stakeholder	Interests
Shareholders	Solvency, earnings volatility, franchise value, reputation and liquidity
Policyholders	Solvency, liquidity, quality of service, reputation
Debt holders	Solvency, debt rating, leverage, liquidity
Regulators	Solvency, compliance, security of policyholder obligations
Employees	Solvency, earnings volatility, growth, reputation

4.4 Characteristics of a good Risk Appetite Statement

The characteristics of a good Risk Appetite Statement would include:

- A holistic statement that sets out an entity's willingness to take on risk;
- Owned by the Board;
- Forward looking – a view of risk that reflects and informs strategy;
- Consistent with the entity's risk framework and strategy, and internally consistent in itself;
- "Tight" wording – allows for effective and proactive monitoring;
- Contains quantitative statements as far as possible;
- Cascadable – relevant to all staff, ties to risk culture; and
- Usable and embedded in day-to-day business decision making.

[5] CRO Forum

In addition, the Risk Appetite Statement should be subject to regular review to ensure that it remains appropriate. Risk Appetite Statements can be set at a high level with the intention of being updated at least every three years.

They should be reviewed annually however to ensure they remain appropriate, but they should also be reviewed:

- If Risk Tolerances are breached; and/or
- If there are material shifts in the organisation's business; and/or
- If there are material shifts in strategic opportunities, or material shifts in market conditions.

The Risk Appetite Statement should be reviewed in conjunction with any strategic review that is undertaken by an organisation.

4.5 Key Risks Covered

There are a number of ways of setting out the elements that should be considered when defining an institution's Risk Appetite. Boards have considerable flexibility in how they define their Risk Appetite and the type of and amounts of risk they choose to have exposure to. However, they are limited to operate within their risk capacity.

The Risk Appetite Statement should cover a small number of what the Board considers to be its key risks. These risks can take various forms:

- Whole company risks – profit, regulatory capital;
- Industry specific risk categories – insurance risk, investment risk, operational risk etc.; and
- Specification of business operations e.g. only one industry, not outside core business etc.

For this paper we have adopted the CRO Forum's four broad categories of risk that a Board should consider in setting an appetite[6]. The CRO Forum suggests using the four broad categories of risk listed below. These risk categories are often observed in publicly available Risk Appetite Statements.

1. Achievement of target performance;
2. Preservation of capital;
3. Maintenance of liquidity; and
4. Protection of franchise value.

These types of risks are '*Enterprise Risks*', Board-level risks, which are not confined to one source. They reflect an aggregation of an underlying (and different) set of "source risks" such as insurance risk, asset risk, credit risk, operational risk etc.

In so far as is practical, for each of these four risks, there should be a clearly articulated qualitative or quantitative bound, or Risk Tolerance. This is essential for the interpretation and monitoring of the Board-approved Risk Appetite Statement and the cascading of Risk Tolerances to Risk Limits.

[6] "Establishing and Embedding Risk Appetite: Practitioners' View", CRO forum. http://www.crocouncil.org/images/CRO_Forum-Council_Risk_Appetite_FINAL.pdf

In CPS 220, paragraph 30(b) states that the RAS should convey "for each material risk, the maximum level of risk that the institution is willing to operate within, expressed as a risk limit and based on its risk appetite, risk profile and capital strength".

When read together with paragraph 28, headed "Material risks", which lists credit risk, market and investment risk etc., it would appear that APRA expects institutions to set a Risk Tolerance for each of the listed risks. If this is the intention of CPS 220, then it may prove difficult in practice to satisfy this requirement as setting a Risk Tolerance for each risk type listed and ensuring that each Risk Tolerance in aggregate is consistent with the overall Risk Appetite may prove difficult. It is imperative that cascaded tolerances tie-back to the enterprise level tolerances that have been set. This may prove difficult in practice if Risk Tolerances have been set for all listed risks.

Some insurers are trying to set a Risk Tolerance for each risk type even where it is not explicitly mentioned in the high level Risk Appetite Statement. This is in addition to the Risk Tolerance set for the high level risks explicitly mentioned in the Risk Appetite Statement.

Other insurers are setting Risk Tolerances only for the high level enterprise risks explicitly mentioned in the Risk Appetite Statement.

4.6 Design

There is no a "one size fits all" design and structure for a Risk Appetite Statement.

Institutions of different sizes and degrees of complexity will have different requirements. There will be material differences between the Risk Appetite Statements of a small mono-line insurer writing risks only in Australia, a multiline insurer with branches and subsidiaries in many countries, and a small Australian branch of a large global insurer.

There are a number of ways of structuring the Risk Appetite Statement. These include:

1. A document which includes both the high level Risk Appetite Statement and associated Risk Tolerances and Risk Limits.
2. A short document on the high level Risk Appetite Statement, and separate papers dealing with Risk Tolerances, Risk Limits and individual Risk Appetite Statements for different risk categories.

The Risk Appetite Statement is a Board-approved document and therefore should be written such that it facilitates discussion with the Board and enables the Board to agree whether it appropriately reflects the organisation's appetite for risk. In addition a good Risk Appetite Statement would enable a new director to quickly and correctly grasp an organisation's Risk Appetite after reading the Risk Appetite Statement.

The Risk Appetite Statement should include the following key elements:

1. It should be clearly linked to the firm's short and long term strategic plans and the associated capital and financial plans.

2. It should establish the amount of risk the firm is prepared to accept in pursuit of its strategic objectives and business plan while considering any relevant constraints.
3. It should clearly articulate the types of risk that the firm is willing to accept as well as the risks it is not willing to accept.
4. It should determine for each material risk (where appropriate) the maximum level of risk (the Risk Tolerance) that the firm is willing to operate within based on its Risk Appetite.
5. Include both quantitative measures and qualitative statements. The quantitative measures will likely include Risk Tolerances for the enterprise level risks and/or material risks. Qualitative statements will likely cover risks that are not as easily measured such as reputational risks.
6. An overview of the main risk classes faced by the organisation. An organisation may choose to have individual Risk Appetite Statements for each of these risk classes.

As commented on above, there are a variety of ways in which the Risk Appetite of an institution can be articulated in a RAS. One approach proposed in this Paper is to have an over-arching RAS approved by the Board which contains details of the appetite, along with relevant Risk Tolerances and Risk Limits, for the key enterprise risks as determined by that institution.

Flowing down from this over-arching RAS, there might also exist an individual RAS for each of the material risks for that institution such as Asset Risk, Operational Risk etc. It is likely that these statements would also include relevant Risk Limits which have also been approved by the Board. Risk Tolerances may also exist at this level but in some cases it may not be practical to determine Risk Tolerances for all risks at this level.

Another level of RAS might also exist where a RAS for each business unit has been determined. This may or may not be a Board-approved document, however, there needs to be a check in place to ensure that the business unit RAS remain consistent with the higher-level Board-approved RAS.

4.7 Additional CPS 220 Requirements

In addition to the above considerations, CPS 220 also requires that, an APRA regulated institution's Risk Appetite Statement must convey:

"(c) the process for ensuring that risk tolerances are set at an appropriate level, based on an estimate of the impact in the event that a risk tolerance is breached, and the likelihood that each material risk is realised;

(d) the process for monitoring compliance with each risk tolerance and for taking appropriate action in the event that it is breached; and

(e) the timing and process for review of the risk appetite and risk tolerances."

5 RISK TOLERANCES AND RISK LIMITS

5.1 Business Outcomes from a Risk Management Perspective

Before we delve into a detailed consideration of risk tolerances and limits, it is useful to consider first how to frame business outcomes from a risk management perspective.

When framed with respect to risk and uncertainty, a business outcome can be considered to be the consequence of an exposure to a risk variable. There are three components to the creation of an outcome:

- the risk factor itself,
- the exposure to the risk factor (essentially a production input), and
- the function that governs the interaction between the risk factor and the exposure.

i.e. Outcome = function (risk factor, exposure)

A simple example of this is the capital return on a zero coupon bond. The outcome is the capital return, the risk factor is the spot interest rate, the exposure is the modified duration, and the interaction function is the product of the change in the spot rate and modified duration.

Now consider uncertainty. There could be uncertainty in one, two or all three components. The bond capital return is considered a simple example because there is typically only uncertainty in one component – interest rate risk. Modified duration and the interaction function are known with certainty. In many insurance examples, there is additional uncertainty in the exposure variable as well, such as where there is insufficient knowledge of the subset of lives exposed to a particular morbidity risk such as mental illness. Complexity increases when there is also uncertainty in the interaction function, such as is the case for many operational, strategic and reputation risks.

Statements of Risk Tolerances and Risk Limits attempt to define one or more of the above elements. In an ideal world, with full knowledge of exposures and interaction functions, Risk Tolerances would be set with respect to outcomes, and Risk Limits would be set with respect to exposure variables. This would apply in any given frame of reference within the business hierarchy: whether it be at the Group level, entity level, business unit level, risk silo level, or functional unit level.

As the levels of the business hierarchy are interconnected, what is an outcome of a lower level is an input into a higher level (e.g. P&L from market risk contributes to business unit P&L, which in turn contributes to entity and group P&L). Thus it is common in practice for Risk Tolerance statements to be primarily set with respect to outcomes and secondarily set with respect to exposures. However, there is nothing necessarily incorrect with setting Risk Tolerance with respect to exposures.

For intermediate and low hierarchical levels of an organisation, statements of Risk Limits are primarily set with respect to exposures (i.e. inputs), but in situations where there is a high level of complexity and uncertainty in the interaction function(s), they can also be set with respect to outputs from business functions that are at a lower hierarchical level.

5.2 Risk Tolerances

5.2.1 Definition

Definition 5: Risk Tolerances

"Risk Tolerances are the quantitative measures and qualitative assertions for the maximum risk allowed by the appetite. Risk tolerances are typically set at the enterprise level."

Risk Tolerances are at a minimum defined on enterprise outcome variables such as profit, value, solvency, liquidity and reputation. However, it is also typical to define Risk Tolerances at least to the next layer down, relating to business units, product lines or material risks. As noted above, they are typically framed in terms of business outputs, but they can also be framed in terms of exposure variables. They are commonly set from a top down perspective, by the Board, and form the keystone upon which all risk based activities of the organisation are based upon.

5.2.2 Components

An expression of Risk Tolerance requires the following elements shown below:

Figure 3: Key elements of a Risk Tolerance

Component of Tolerance	Examples
Identification and definition of the set of strategic outcomes or exposure variables upon which risk will be expressed	Profit, solvency, value, liquidity, reputation, individual risks
What the planned outcome is	EBITDA growth of 8%, Solvency ratio of 150%
What the tolerated outcome is	EBITDA growth of 0%, Solvency ratio of 120%
An expression of the frequency of the tolerated outcome	5%, or 1 in 10 years

The first component requires the organisation to clearly articulate what the organisation is trying to achieve. What are its goals:

- Financial goals: profitability, solvency, valuation, growth, liquidity, policyholder benefits, etc.
- Non-financial goals: reputation, market position, environmental sustainability etc.

These are the elements which frame strategy. The next step is then to define what the planned strategic outcome is for each of these goals. This sets a benchmark for assessing performance relative to the agreed strategy. The next step is to then consider the uncertainty around each of these outcomes, and in particular, define the undesirable outcomes for each of these elements. Within this set of possible outcomes, an expression of a bad tolerable outcome is defined, along with an

expression regarding its frequency. This Risk Tolerance expression defines the risk constraints for the entire Risk Management Framework.

The expression of frequency is important as it explicitly recognises that outcomes are uncertain, and that people don't always mean that they want a 0% chance of outcomes outside of this level. For example, they might tolerate a 0% EBITDA growth rate of 1 in every 10 years. Another obvious example is APRA's ICAAP framework, which expresses a risk tolerance level for firm failure at the 99.5th % level (1 in every 200 years). However in some cases it is not possible, meaningful or desirable to define an expression of frequency, such as for an immature risk framework. Risk managers should consider whether such frequency statements are being made implicitly by people and if so, make them explicit.

The RAS may also contain expressions of preferences for being exposed to certain types of risk. This is essentially an alternative way of expressing that a risk exposure should be zero. For example, it may say that we have no appetite for taking on a particular class of insurance risk, such as longevity risk. The combination of these means that the RAS is defining a set of preferences for where the organisation would like to take risk in order to achieve its strategic objectives.

5.2.3 Unit of Measurement

It is also important to clearly define the unit of measurement that is being used. The unit of measurement of the risk must be the same as that of the variable itself, otherwise problems will arise. For example, when considering solvency, a typical measure would be a solvency ratio of actual to required, expressed as a percentage. Thus the unit of measurement of risk should also be on this basis. Significant communication, cascading and risk control issues would otherwise arise if it was defined on a different measure, such as qualitatively i.e. strong / adequate / insolvent.

The unit of measurement itself could be either quantitative or qualitative. Either approach will work. There should be a preference for quantitative measures, simply because these are objectively defined, and have no ambiguity in their interpretation. However not all risks can be defined quantitatively, and thus qualitative measures are sometimes a necessity. These will use descriptive language such as low / medium / high, red / amber / green, or strong / weak. In using qualitative measures, it is critical to be aware of the degree of ambiguity and thus additional uncertainty that these create, as different people will interpret these states differently. This uncertainty should be taken into account when calibrating the Risk Appetite Framework.

5.2.4 Setting Risk Tolerances

Risk Tolerances are ultimately determined by the Board using judgment after considering analysis and input from executive management. The additional concepts of planned outcomes, Risk Capacity and actual risk levels can be very useful in providing context in this process.

It may be useful to work through the following questions as part of the process:

- What are the products and services offered by this business?
- How is this impacted by the business environment?
- What are its key targets or KPIs?
- What are the main areas of risk to which it is exposed?

- What are the key factors which could cause issues in meetings its targets?

This will indicate the areas for which risk metrics are required.

Some further questioning will help to hone in around metrics:

- Are there existing decisions or processes which give a view around the acceptability of this risk? What level of variance has typically resulted in investigations or action? Past decisions give a view of the implicit attitude to this kind of risk.
- At a high level, how is this risk viewed relative to others? For example, based on its internal capability and experience, a company may feel more comfortable in accepting Market Risk than Insurance Risk. As a result, it would want to set tighter tolerances around Insurance Risk as compared to Market Risk.
- What kind of a scenario would be viewed as acceptable? What kind of scenario would be viewed as catastrophic? Are there examples from within the business itself or in the wider market that the board would want to ensure it could withstand?
- What kind of metrics are currently used for business management? Are these appropriate for risk reporting? Close alignment between business and risk reporting will help in the vital step of embedding risk concepts within business areas.

Risk Capacity in particular can be a useful concept to help the setting of Risk Tolerance, as Risk Tolerance levels are constrained by Risk Capacity. Whilst Risk Capacity would ideally be determined prior to setting Risk Tolerance, in practice it is more common for Risk Tolerances to be drafted and then Risk Capacity being considered. Either approach works in this chicken and egg situation, it is the comparison that is ultimately important. Note that the difference between Risk Capacity and Risk Tolerance levels provides one indication of the level of planned resilience of the organisation. Large systemically important organisations are more likely to have bigger buffers between capacity and tolerance, whilst small new entrants are more likely to be operating with minimal buffers and thus be more fragile.

Some examples of Risk Tolerance statements include:

Figure 4: An example of a Risk Tolerance statement

Statement	**Target Capital is set such that the probability of meeting regulatory requirements over one year is at least 97.5%.**
Outcome / Exposure Variable	Probability of meeting regulatory requirements (outcome variable with units of %)
Planned Outcome	100%
Tolerated Outcome	97.5%
Frequency	2.5 in 100 years (or 1 in 40 years)

Note that in this example, Target Capital is the input risk driver upon which a Risk Limit (of say $x million) would be set to give the required probability level.

Figure 5: An example of a Risk Tolerance statement

Statement	The Board expects earnings to deviate by no more than 10% from the Financial Plan under normal business conditions
Outcome / Exposure Variable	Earnings (e.g. EBITDA or NPAT) conditional on normal business conditions. An outcome variable with units of $m (or % change)
Planned Outcome	100% of Plan
Tolerated Outcome	+/- 10% of Plan
Frequency	0% implied. Any breach will trigger risk response actions. Note that this may not always be the case, particularly for business lines with high uncertainty / volatility

Figure 6: An example of a Risk Tolerance statement

Statement	The company targets an S&P AA range credit rating
Outcome / Exposure Variable	S&P credit rating (an outcome variable with defined states)
Planned Outcome	AA
Tolerated Outcome	AA-
Frequency	0% implied. Any breach will trigger risk response actions

Figure 7: An example of a Risk Tolerance statement

Statement	There is no appetite for a particular market segment, product line or risk
Outcome / Exposure Variable	Risk protection market, or disability income products, or morbidity risk (all exposure variables)
Planned Outcome	Zero exposure
Tolerated Outcome	Zero exposure
Frequency	0% implied. Any breach will trigger risk response actions

Figure 8: An example of a Risk Tolerance statement

Statement	The company must have cash holdings or equivalents to meet daily operational funding needs and forecast expenditure over a specified time period
Outcome / Exposure Variable	Cash holdings (an outcome variable with units of $)
Planned Outcome	$10m
Tolerated Outcome	$5m, equal to funding needs and forecast expenditure over a specified time period
Frequency	0% implied. Any breach will trigger risk response actions

Figure 9: An example of a Risk Tolerance statement

Statement	Sufficient liquidity must be held in the Statutory Funds to meet clients' claims or withdrawals of invested funds in both normal daily operating scenarios and defined stress scenarios.
Outcome / Exposure Variable	Statutory Fund Liquidity (outcome variable with units of $ or % if a ratio of available / expected)
Planned Outcome	Liquidity ratio of 125%
Tolerated Outcome	Liquidity ratio of 105% under normal and stress scenarios
Frequency	0% implied. Any breach will trigger risk response actions

Figure 10: An example of a Risk Tolerance statement

Statement	Investment of assets backing policyholder liabilities should aim for close matching by duration
Outcome / Exposure Variable	Net dollar rho (asset less liability rate sensitivity) of a specific balance sheet (exposure variable measured in $)
Planned Outcome	$0
Tolerated Outcome	$50,000
Frequency	5% measured daily over a rolling 12 month period. Any breach will trigger a review

Figure 11: An example of a Risk Tolerance statement

Statement	Investment of assets backing shareholder equity should have a volatility expectation of x
Outcome / Exposure Variable	Asset volatility annualized (outcome variable measured in units of %)
Planned Outcome	5%
Tolerated Outcome	7.5%
Frequency	10% measured weekly over a rolling 12 month period. Any breach will trigger a review

Note that breaches of Risk Tolerance for outcome variables can occur in two forms, depending upon the frequency statement. Where there is an explicit and non-zero frequency statement, then a specific breach may not imply a breach of the frequency statement. Consider for example earnings results being more than 10% below plan (the Risk Tolerance). If the frequency statement says that this result is okay if it occurs less than 1 in every 10 years (10% likelihood), then more evidence is needed in order to assess whether the result warrants a remedial risk response, although a review will typically be undertaken. However if there is no obvious statement of frequency, then this typically implies a 0% likelihood, which will trigger risk response actions.

5.3 Risk Limits

5.3.1 Definition

Definition 6: Risk Limits

"The restrictions prescribed by an institution on its business activities, designed to constrain overall risk taking within the Risk Tolerances established in the Risk Appetite Statement. Risk Limits are operational in nature and serve to cascade the Risk Tolerances (contained in the Risk Appetite Statement) into practical constraints on business activities."

For many companies, Risk Limits provide operational controls at the level of the organisation that manages the risk on a day-to-day basis. They are expressed in metrics that are locally relevant and convenient to monitor and are often thought to "act as a brake against excessive risk-taking".

5.3.2 Attributes of Effective Risk Limits

Before discussing implementation we set out five criteria we believe make sense in assessing whether Risk Limits are effective.

- **Limits must be measurable**. If a risk owner can't tell if they are within a limit they can't take remediation action.

- **Quantitative Limits are preferable, where feasible**. We recognise that some limits may not be amenable to quantification. However, where limits can be expressed quantitatively they should be.
- **Limits should be sufficiently binding as to potentially restrict the business**. A limit that cannot be reached doesn't help a risk owner in conducting business but may impose a reporting burden. They also lead to a blasé attitude to the risk function.
- **Limits should be unambiguous**. Discussion should be about what the limits should be, not whether they were breached or not.
- **Limits should be expressed in the language of the business**. The limits will be discussed and agreed with the risk owners. It is important that they be expressed in terms risk owners and the business can understand, measure and act on.

5.3.3 Examples of Risk Limits

Some examples of Risk Limits are shown in the table below.

Figure 12: Examples of Risk Limits

Ease of Quantifying	Category (Risk or Other)	Risk Type	Examples
Easy	Market	Equity, property	$5,000 net delta against the S&P/ASX 200 index and S&P/ASX Property Index
	Market	Interest rate	$10,000 net rho for parallel shifts
	Business line	Various	Max new business annuity sales of $100m
	Credit	Counterparty Default	Max 10% exposure per counterparty
	Liquidity	Short term cash flow mismatch	Min $10m held in liquid assets
Moderate	Insurance	Underwriting	$2m per case per senior underwriter
	Insurance	Mortality / morbidity	Minimum reinsurance coverage of $m
	Insurance	Policyholder behaviour (e.g. lapse)	Retention process success rate of at least 50%
Difficult	Operational	OH&S	Zero tolerance for fraudulent behaviour of staff
	Reputation	Brand	Minimum brand awareness scores

5.4 Monitoring and Breaches of Risk Appetite

Monitoring of risk levels against Risk Tolerance and Risk Limits is a key risk management function. Risk dashboards are generally used to facilitate this. These are commonly based on traffic light indicators, which presents visual information of where the various risks are sitting in relation to the Risk Appetite.

- **Green** : the risk is within tolerance / limits that the business is comfortable with
- **Amber**: the risk has exceeded a comfortable level, warranting close monitoring and consideration of remedial action to return the rating to Green.
- **Red**: The risk has exceeded the allowable tolerances / limits, going outside Risk Appetite. Remedial action must be put in place, with clear accountabilities, metrics and timeframes. It may also be appropriate to revisit the tolerance to determine if it is still appropriate.

Outcomes that have breached Risk Tolerance levels do not necessarily breach the Risk Tolerance, as the frequency statement may not have been breached. Technically it is necessary to build up enough evidence in order to decide whether a breach has actually occurred or not. This is particularly important for relatively low Risk Tolerance levels on high frequency risks, such as market risks, where a daily VaR limit may be exceeded multiple times within a given period, which would be entirely expected and consistent with the Risk Appetite Framework. However, all breaches of Risk Tolerances and Risk Limits will typically result in a review.

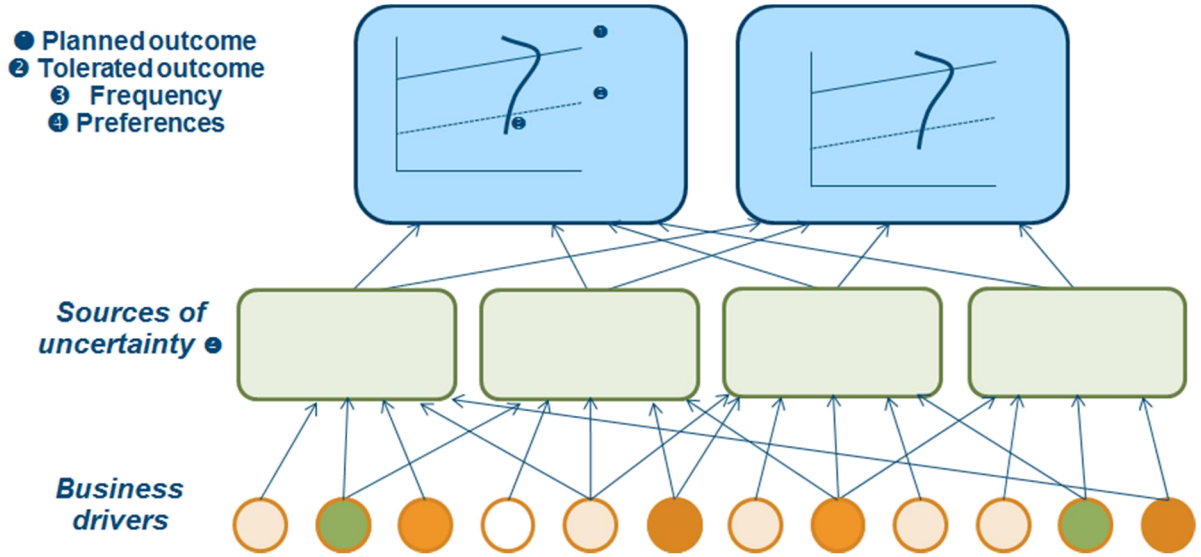
6 Calculating and Cascading Risk Tolerances to Risk Limits

6.1 Overview

The setting of Risk Tolerances and Risk Limits is a central part of the risk management process. Setting Risk Tolerances enables Boards to be able to clearly communicate the range of business outcomes and risk exposures that are and are not desirable. These are then translated into a consistent set of Risk Limits on business inputs that define and constrain risk taking activities, both risk bearing and risk mitigating.

Unlike Risk Tolerances which are set using the judgment of the Board, Risk Limits can be determined using a variety of approaches. The gold standard is to start with the outcome constraints as defined by the Risk Tolerances, and work backwards to determine the set of constraints on input variables that are consistent with the outputs. Like most management problems, this is hard because it is inherently a complex inference problem. Insurance organisations are essentially complex adaptive systems, whereby a multitude of input drivers combine and interact in complex non-linear ways to produce a set of outputs. In many cases, there is often not a simple linear one-to-one relationship between inputs and outputs, but rather it is characterised by many-to-many relationship structures in a multidimensional web between inputs and outputs within a hierarchical organisation, as illustrated below.

Figure 13: A conceptual diagram characterising the complex relationships between business driver inputs, the various sources of uncertainty (e.g. risk categories) and business outcomes (e.g. profit, value). Source: Milliman



The nature of these inter-relationships governs the techniques that will be useful in cascading Risk Tolerances to Risk Limits. This requires understanding, describing and modelling the nature of the system that characterises the evolving dynamics of the inter-relationships between and amongst the inputs and outputs.

The following table outlines the types of techniques that are likely to be useful in cascading Risk Tolerances to Risk Limits.

Figure 14: Useful techniques for cascading tolerances to limits

Nature of System	Technique
Deterministic	Direct (mathematical risk statistics)

Complicated	Euler methods, causal simulation models, segmentation analysis
Chaotic	None
Stochastic	Frequentist statistics
Complex	Causal and structural models, Bayesian statistics / networks

As shown, a range of techniques can be used, although many are dependent upon the nature of the system being considered. One measure of maturity of the Risk Appetite Framework is a recognition of what types of systems govern risk across the business, and using the appropriate technique to the right level of depth to meaningfully cascade Risk Tolerances into limits. Without the ability to understand the relationships between business inputs and outputs, the business will not be able to meaningfully control risk.

Each of the above techniques itself requires calibration, which we discuss first before turning attention to each type of system.

6.2 Calibration

There are multiple techniques that can be used to calibrate Risk Appetite Statements. It is important that an organisation understands where they are at in the evolution of their risk management practices. If an organisation is at a relatively immature stage it is important that it recognises that it may be employing a relatively simple approach for addressing a potentially complex issue and, if this is the case, then any limitations of that approach should be understood.

Performing stress and reverse stress tests can be a useful way to help stakeholders and risk managers to determine Risk Tolerances and Risk Limits. Stress tests involve determining the values for a set of input variables (univariate in the case of one variable, multivariate otherwise) that are used to calculate the impact on a range of output variables of interest. Reverse stress tests involve determining the values for a set of output variables of interest, that are then used to calculate what combination of input variables could give rise to them. Both techniques can be used to analyse the input-output relationship, which can help to determine Risk Limits depending upon the type of system one is dealing with. They also both require a model to describe how business inputs are translated into business outputs.

Information sources that can be used to calibrate stress and reverse stress tests include:

- Historic data: this includes data to derive statistical distributions and to identify univariate and multivariate stress tests of relevance. When such tests are performed on historic data (either at a point in time or in a time series), they are referred to as back-tests.
- Current market data: this includes risk metrics that can be implied from current market measures, for example implied volatility for capital market risks such as interest rates and equity indices.
- Expert judgment: forward looking assessments which avoid the limitations of historic and current data, but introduce other limitations such as behavioural biases.

There are many examples where there may be existing quantitative models that can be leveraged, particularly in the case of complicated systems. Examples include:

- Capital models, whether regulatory standard models or internal capital models;
- Profit models, particularly those relating to actuarial and finance;
- Asset and credit risk models;
- Operational risk models; and
- Balance sheet models, particularly asset-liability models of particular classes of business or products.

As risk management becomes more sophisticated over time, new models will be developed for other risks such as risk culture, strategic and operational risks that will enhance the ability of risk managers to calibrate Risk Appetite Statements.

6.3 Deterministic Systems

A deterministic system is one in which there is no uncertainty about future outcomes. If the initial conditions are known with certainty, the system is perfectly predictable and able to be completely described mathematically. In the context of risk, we modify this slightly to consider that there are sources of uncertainty, but the relationship between input uncertainty (e.g. Risk Limits) and output uncertainty (e.g. Risk Tolerances) is known with mathematical certainty.

Take the earlier example of the capital return on a zero coupon bond. The outcome is the capital return, the risk factor is the spot interest rate, the exposure is the modified duration, and the interaction function is the product of change in the spot rate and modified duration. This is an example of a deterministic system that is fully definable in linear mathematical terms.

Now consider the uncertainty in the problem. There is no uncertainty in the duration estimate, since this is directly observable, nor is there any uncertainty in the interaction function, which is prescribed mathematically. There is only uncertainty in the risk variable relating to interest rates. Interest rate risk is an area that has a number of well accepted models that are capable of characterising interest rate uncertainty, leveraging both observable and judgmental information. For any given model, assuming that it is a correct description of the risk, it is possible to uniquely determine what exposure input (Risk Limit) corresponds to a particular outcome (Risk Tolerance). For example, assuming that a Risk Tolerance for the 12 month projected return on the bond was set to say -10% at the 95th percentile level (i.e. 1 in 20 years), and assuming a flat interest rate volatility curve at the 1% level (with a normally distributed residuals), then the equivalent 95th percentile rate move is +1.64%. Thus the Risk Limit on the modified duration exposure variable that results in a Risk Tolerance return of -10%, is uniquely determined as 6.08 years (=10%/1.64%).

These types of linear calculations can be made wherever the nature of the system being described is a deterministic one. Such a deterministic system is characterised by linear, mathematically definable relationships between risk inputs and risk outputs. The nature of the relationship is typically a simple mathematical function such as being additive or multiplicative. This is usually the case when it comes to cascading the highest levels of the RAS, relating to elements such as profit, value and solvency, as these tend to be linear aggregates of their components (revenue, expenses, assets, liabilities, risk capital components etc.). It also sometimes holds for

the next layer down, where some of these elements can be broken down mathematically into risk factor exposures. For example, asset and liability values can be derived as a function of risk factors and risk factor exposures (e.g. the Greeks with respect to market risk, and insurance risks with respect to liabilities).

Risks that are amenable to this type of approach include many market risks, credit risks, liquidity risks and some insurance risks such as mortality. It is always a good place to start with identifying and cascading risks in deterministic systems, because it is a simple and objective process to do so.

6.4 Complicated Systems

The next level of difficulty arises when dealing with systems that are complicated. These systems are characterised by many components following simple one-to-many relationships for which it is difficult for a person to understand without the need for some specialised framework/model construct. However when modelled, they have a high degree of predictability (i.e. low uncertainty). Rocket science is complicated, but the physics of it are well known, and we now have very high levels of predictability in outcomes. Hierarchical systems such as organisational charts, business unit structures, balance sheets, capital structures, accounting and product structures are also examples of this, as the relationships between the components are characterised by one to many.

Such systems are amenable to modelling using traditional methods such as segmentation, deterministic models, and linear inter-relationship models (e.g. Generalised Linear Models or GLMs). These models are all about deriving relationships between a series of inputs and specific outputs of interest. It is possible and meaningful to decompose a high level Risk Tolerance into a more granular Risk Limit in a prescribed and mechanical way.

An obvious place to start is with segmentation of a business outcome. Segmentation is common for conglomerate groups where strategic plans and Risk Appetite Statements are required not just at the enterprise level, but also at the divisional level. Scenario analysis can be a useful tool here to help stakeholders at each level articulate not just planned outcomes, but also Risk Tolerance outcomes that apply at that level.

Within each division, it is also typical to segment planned outcomes by product lines, legal entities and / or statutory funds. In an ex-post sense, the whole is considered to be the sum of the parts, as this is how historic descriptive analysis works. It is thus tempting, and relatively common, to use this same approach for ex-ante risk management, and just add up all the risk numbers across the parts, or equivalently, pro-rata the overall Risk Tolerances back down across the parts in accordance with their relative weights (based on some appropriate metric). Whilst this will no doubt provide an interesting result, it is incomplete, as risk needs to account not just for the additive nature of the elements, but also account for the inter-relationships between them.

The typical solution to the equivalent risk aggregation problem is the use of linear correlation metrics. When it comes to risk (and capital) allocation, Euler methods[7] can be used which are based upon a risk exposure's marginal allocations to total risk. This method suggests that risk contributions are the first-order derivatives of the

[7] Refer http://www.math.vu.nl/~sbhulai/theses/thesis-kyselova.pdf; http://www.sas.com/resources/whitepaper/wp_18279.pdf and http://lema.smeal.psu.edu/risk/files/2012/04/2011BauerZanjani_CapAlloc.pdf as useful examples

aggregate risk with respect to the sub-components. This approach is mathematically elegant and conceptually attractive as the marginal contributions to risk can be used to allocate the diversification benefit.

This technique can be useful to cascade Risk Tolerance measures down through the various hierarchical structures both above and within each risk silo. Overall allocation of risks across the various risk silos, as well as within particular risk silos is typical.

However this approach does have two major limiting assumptions. The first is that it assumes that risk contributions are stable, meaning that small changes in risk lead only to small changes in risk contributions. The second is that it is assumed that the risk statistic under consideration is coherent. Whilst Value at Risk ("VaR") is the typical way of expressing a Risk Tolerance measure, it is important to note that it is not a coherent risk measure. Coherent risk measures must have the following properties, as outlined by Artzner et al (1999):

- **Monotonicity**: If A always has better outcomes than B, then the risk of A should be less than B.
- **Sub-additivity**: If two risks are added together, their combined risk cannot be any greater than the sum of the two risks separately. This is the principle of diversification.
- **Positive homogeneity**: The application of a scalar factor to the underlying variable should similarly scale the risk measure.
- **Translation invariance**: Adding a risk-free element to the variable reduces risk by the same amount

If a risk measure isn't coherent and when distributions are highly skewed, heavy-tailed, or far from normal, problems can arise such as negative diversification or allocation benefits. For example, say the Risk Limit VaR from each independent source A and B is 100 and 50, respectively, but when combined into A + B, the VaR is 200. The non-sub-additivity effect is also emphasised by some distributions with heavy right tail asymmetries, such as the lognormal, which is also one of the most commonly used distributions to model insurance severity variables.

As a consequence of this property of VaR, serious consideration should be given to the use of alternative Risk Tolerance statistics that are coherent such as expected shortfall (also known as tail-VaR and conditional tail expectation CTE).

Risk managers thus face an important choice: either use VaR which is understandable by stakeholders but has serious coherency problems making cascading extremely difficult, or use a coherent risk measure such as CTE which enables proper cascading but which stakeholders are not likely to understand. One common approach that we believe has significant merit is to use VaR statistics to set Risk Tolerance levels as it is critical for stakeholders to be able to relate to them. Then for business critical items such as capital allocation, translate the VaR into an equivalent coherent risk statistic such as a CTE, and use it as the basis for cascading it throughout the business.

6.5 Chaotic Systems

Some systems are characterised by chaotic behaviour. This means that small changes in inputs result in extremely large changes in outputs. Some systems which may superficially look deterministic, are actually chaotic due to the inherent uncertainty in measuring the initial conditions. For example, even relatively simple mathematical equations such as the Lorenz and Rossler equations exhibit chaotic behaviour.

The weather system is another example of this, as are situations of war, political, capital market, economic and business instability. It is meaningless to try to infer a set of Risk Limits on inputs for a given Risk Tolerance outcome for such systems, due to the hyper-sensitive nature of their inputs. Even if the inputs are controllable to some extent (unlike those of the weather), this is a fruitless exercise. Luckily insurance organisations are rarely characterised by such systems as it would make the business completely unmanageable, particularly from a risk management perspective. Identifying a chaotic system can be done through sensitivity testing the outcomes to changes in initial conditions, and looking for extreme non-linear behaviour.

6.6 Stochastic Systems

Random systems are characterised by random variables whose future states are uncertain, and can be modelled via stochastic processes. These systems require models that characterise uncertainty using probability distributions. Such probability distributions may be unconditional (e.g. equity market returns) or conditional (e.g. interest rates as a function of duration).

Such systems are widely present in life insurance, particularly with respect to market and insurance risks. Where multiple random variables are present, their inter-relationships are typically modelled using simplifying assumptions such as independence or linear dependence, both of which simplify the mathematics considerably.

These systems have played a central role in life insurance, as they have underpinned the assumption of the independence of lives, which has allowed the use of the law of large numbers to diversify unsystematic risk, resulting in the benefits of pooling. The only way to model risk in such a system is to identify the varying degrees of uncertainty that are a result of small sample sizes before the law of large numbers comes into effect. In this context, a Risk Tolerance measure can only be cascaded down one level to determine the equivalent scalar variable Risk Limit (number of observations / sample size / number of policies) for a given risk distribution.

The reality is that almost all stochastic systems are in fact complex adaptive systems. However, because the latter are difficult to describe, model and manage causally, the approach taken is to treat these as random stochastic processes instead. It is necessary for the modeller and risk manager to assess the relative benefits of drilling down into the next layer of causality, versus the relative cost of doing so. Risk materiality and resource constraints play key roles in this decision.

6.7 Complex Adaptive Systems

So what do you do if you are facing any of the following situations:

- An unknown, incomplete or unstable risk distribution;
- Non-linear relationships where risk is characterised by regimes which exhibit state dependence and tipping points;

- Non-hierarchical relationships, characterised by many-to-many relationships between inputs and outputs;
- Qualitative, causal risk drivers that cannot be readily quantified;
- Dynamic, adaptive behaviour such that the relationship between risk inputs and outputs are changing; and
- Feedback loops between inputs and outputs.

These conditions break the assumptions upon which the previous approaches are based. Unfortunately, many of the problems that risk managers face are characterised by systems that have the above attributes. In these situations, you are dealing with complex adaptive systems.

A complex adaptive system is a purposeful macroscopic system consisting of numerous self-organising, highly connected components that adapt to the environment and evolve over time. The link between the components are characterised by many-to-many relationships, and although outcomes can be predictable, they are uncertain and subject to non-linear and sometimes counterintuitive behaviour. Such systems are able to be characterised, but not using traditional methods. Instead, they require complexity science techniques to understand the network of risk drivers, their cause to effect relationships, as well as their inter-dependencies.

Life insurance risks that follow this include:

- Market risks, such as equity, interest rate and credit risks, which are causal functions of economic, demographic and other financial variables;
- Insurance risks, such as lapse and morbidity, which are causal functions of product relative value propositions and household finance (lapse), and lifestyle and genetics factors (morbidity);
- Liquidity risks, which are largely behavioural driven, by both capital market participants and consumers more generally;
- Operational risk, which involve a range of people, processes, systems and external factors; and
- The interaction of many of the above risk factors. For example, a market risk stress can increase the chance of an operational risk failure due to the additional stress placed on operational activities.

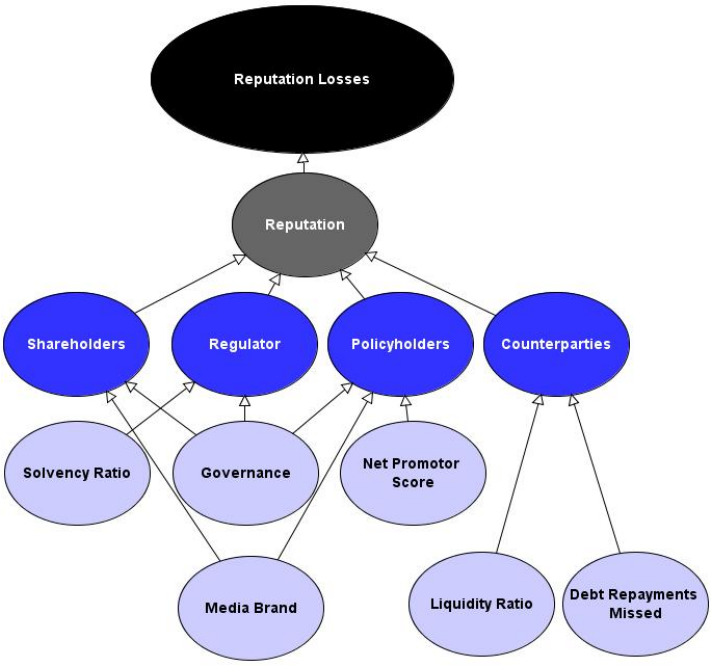
Due to the biological limitations of our prefrontal cortex, people are unable to cognitively process this complexity. Consequently, they seek to keep things simple enough so that they can understand an element of the problem, typically through the use of simple heuristics, or by setting Risk Limits on input variables from a bottom up perspective, assuming that they are independent of one another. Unfortunately these approaches do not work for complex adaptive systems, as much of the risk arises from the non-linear interactions between the causal drivers. Risk appetite will tend to break down under these conditions, which will undermine the framework. A better solution is instead needed.

The science of understanding complex systems is well advanced, with a significant body of work having been developed over recent decades. Whilst this has been used successfully in a number of industries, application in financial services has only

occurred over the last 5 -10 years. In particular, some of the more mature organisations have started using complex systems techniques for the purposes of solving the risk aggregation and risk allocation / Risk Appetite cascading problem.

The starting point for this work is to elicit the causal system or network of cause to effect relationships holistically in a qualitative sense. An example of the drivers of reputational losses is shown below.

Figure 15: A simple cognitive map of the consequential losses from and causal drivers of reputation risk. Each causal driver (in dark blue) represents reputation from a different stakeholder, the states of which in turn are informed by various risk indicators (in light blue).



Each node above represents a variable of interest, with the links between the nodes showing the direction of causality. The outcome variable is the dollar loss distribution from reputational events. Below this are the causal risk drivers, relating to the reputation amongst various stakeholders. Overall reputation is a function of each of these, since a stress in any category is likely to influence the overall reputation of the organisation. These causal risks in turn are dependent upon various factors or risk indicators, such as solvency ratio, governance, and brand, all of which influence what state the causal risk drivers themselves are likely to be in. For example, if the firm has a poor media brand, then this is likely to impact reputation (at least) amongst shareholders, regulators and policyholder.

The risk indicators represent *inputs* into the system that determines the reputational loss *output*. Note that these variables can be a mixture of controllable and uncontrollable production variables, which may in turn be an output of some other more complex process (such as solvency and liquidity ratios). Nevertheless, if this system qualitatively describes how reputational risk operates, it is necessary to cascade a Risk Tolerance on reputational losses (or the state of reputation itself) into meaningful Risk Limits on the underlying input variables.

When faced with the above problem, it is tempting to solve this problem through the use of a univariate approach, by asking what state must a single risk indicator be in with everything else unchanged, in order to breach the overall Risk Tolerance on reputational losses? Whilst this yields an answer, it is not a very helpful answer as it treats the state of all the other risk indicators as fixed and irrelevant, which is typically not the case.

Instead, the solution is that it is necessary (and extremely valuable) to ask the hard questions in order to elicit the dynamics of how the cause to effect relationships operate to generate outcomes. This includes addressing:

- What the states are of the outcome, the risk itself, the causal risk factors and the risk indicators. These should be couched in the language that the business communicates in. For example, reputation could be considered to have three states: positive, weakened and bad, whilst media brand could be considered to have three states of good, fair and poor.
- What are the relationships that govern how risk indicators and the causal risk drivers operate. Are they simple weighted aggregates? Are there any tipping points, skew and non-linearities? What is the uncertainty inherent in these relationships?
- Similarly how do the various stakeholder reputations aggregate into a single reputational view? Are they simple weighted aggregates? If so, which ones are relatively more important? Are there any tipping points, skew and non-linearities?

Addressing these questions can be hard, because people don't often try to codify this information. However this information does exist, mostly in people's mental models, as evidenced in how they communicate their narrative of what drives the reputation of the company. In some cases quantitative data might also exist in which case traditional small analytics can be performed to uncover the relationships. Working through this process structurally is a mechanism for codifying the collective intellectual property that exists across the organisation about how risk operates, enabling it to be analysed, tested, and refined.

It should be noted that various risks can become significantly more complex than this simple example, but this approach is able to handle such complexity. Refer to Allan et al (2011)[8] for a more complex example.

Once this process is complete, the information can be captured in the form of a Bayesian Network model. The advantage of this is that inference techniques can now be formally used to reverse propagate a conditional outcome such as a Risk Tolerance, to work out all the possible combinations of states on the input variables that are consistent with the outcomes. Importantly, these are interdependent multi-variate results, which will find the most likely combination of minimum Risk Limits across all the risk indicators. These are the true boundary points for the Risk Limits, below which it is not possible to breach Risk Tolerance regardless of the state of any other risk indicators.

It is also worth stating that this approach addresses the coherence problem previously mentioned. This is because the full risk distributions are being derived for

[8] Allan N., Cantle P., Godfrey P., Yin Y., 2011, "A review of the use of complex systems applied to risk appetite and emerging risks in ERM practice", Institute and Faculty of Actuaries, 28 November 2011

each variable, taking into account directly the complex non-linear inter-relationships between the components. It is thus possible to mix and match different types of risk statistics, such as VaR and CTE, regardless of whether they are coherent or not. There is also no need to invoke a correlation matrix to aggregate risk or other allocation techniques to allocate a risk statistic.

Refer to Appendix A.2 for a quantitative worked example using the above method to set Risk Limits via cascading a Risk Tolerance outcome.

7 PROCESS FOR SETTING THE RISK APPETITE FRAMEWORK

7.1 Introduction

Effective risk management within a life insurance company should include a formal process for setting the Risk Appetite Framework. The framework presented below is not specific to a life insurance context and has been developed in collaboration with other practice areas[9].

The purpose of this section is not to prescribe the formal process, but rather to encourage thought around how current processes may be improved or revised for a more robust framework. Many of the elements that make up the process are discussed in more detail in other sections of the paper.

At a minimum, a Board will approve the company-wide Risk Appetite Framework and Risk Appetite Statement, which is highly likely to be developed in collaboration with the chief executive officer (CEO), chief risk officer (CRO) and chief financial officer (CFO). The CEO, CRO and CFO will be likely to play leading roles in translating those expectations into targets and constraints for a company (and subsequent cascading to business units or product lines) to follow.

An effective Risk Appetite Framework should aim to be transparent and integrated within the business. Whatever process is implemented, the guiding principles discussed in Section 2 of this Paper should be followed.

7.2 Generic Process

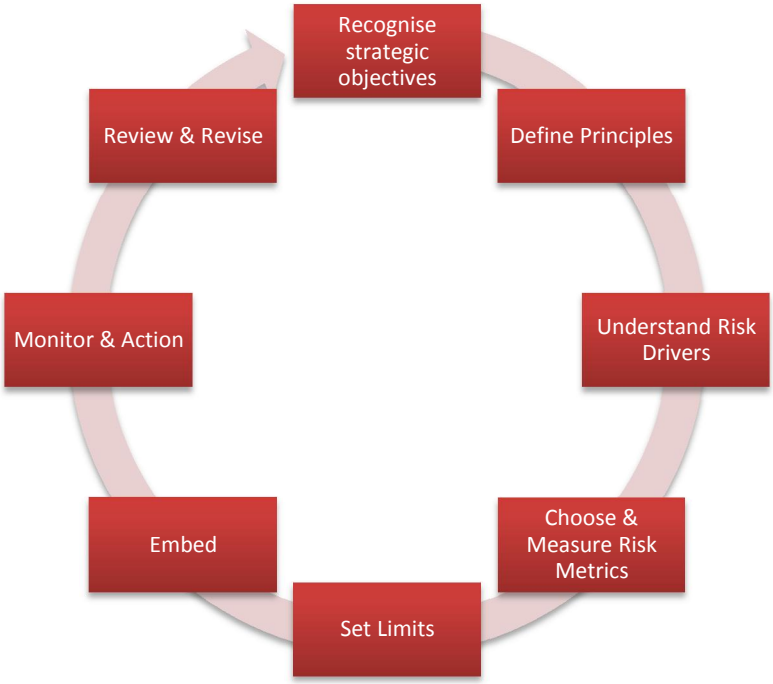
The following figure outlines a generic process for setting the Risk Appetite Framework. Most implemented approaches will broadly align with this structure. However, there is not a one size fits all solution, particularly given the diversity across life insurance entities. Importantly, managing a Risk Appetite Framework-setting process iteratively is superior to not incorporating learnings into the framework.

There are a number of quantitative and qualitative tools that can assist across the entire process, such as internal workshops, SWOT analysis, risk registers, discussions with external stakeholders, scenario testing and internal capital models.

Ideally there should be also be regular communication across the breath of the organisation to ensure that there is the best possible opportunity to capture the interaction of risk events across the organisation and also any emerging risks.

[9] Such as the General Insurance Risk Appetite Working Party

Figure 16: Generic process for setting the RAF



A description of each phase is given below:

1. **Recognise strategic objectives** – This initial phase helps the Board to frame business objectives in risk appetite terms; the ability and willingness to take risks in pursuit of the strategic plan is defined here.

2. **Define principles** – This step aims to define and communicate at Board level the principles of the Risk Appetite Framework (as referred to in Section 2) including establishing consistent definitions, identifying stakeholders and process owners and setting the main scope of the Risk Appetite Framework. This phase will include an evaluation of the risk management activities being undertaken so far.

3. **Understand risk drivers** – This step ensures all significant risks are identified and considered by the Board. The process should include, at a minimum, the APRA prescribed risk categories discussed in Section 3. These minimum risk categories can be further articulated into underlying risk drivers as the complexity of the business dictates. Understanding can only be gained through an analysis of the external and internal environment in which the insurer operates. For example, the various business lines that can make up a life insurance portfolio may have very different risk profiles e.g. annuities vs. death cover. The Risk Appetite Framework process needs to consider the structural differences in the risk and return characteristics between different business lines.

4. **Choose and measure risk metrics** – The choice of risk metrics (such as the probability of meeting capital requirements over a given time horizon) will determine what managers learn about the current risk position of the organisation. Therefore appropriate risk metrics should align with the business objectives of the organisation and expectations of stakeholders. This stage will involve a quantification process to determine which risks are the material ones, but one should also be aware of the limitations of such a process. If an important risk is not measured correctly then the risk may be ignored or misinterpreted by executive management. Stochastic modelling, or other techniques, can be used to calculate probability of impairment below a capital threshold.

5. **Set appetite, tolerances, and limits** – To align risk with return and business strategy, selected risk targets should encourage those risks that are rewarded and discourage those that offer little return for stakeholders. It is this stage that defines what are unacceptable outcomes. In setting limits the organisation must consider Risk Tolerance as an upper bound to Risk Appetite. Again, quantification methods can be used to select appropriate limits and tolerances. This stage will also include qualitative statements from management that determine the tone of the risk management approach within an organisation. In considering these levels, the Board should consider its appetite for significant outcomes – examples of these could include:

    - How often is an underwriting loss for the company acceptable?
    - What is the worst over-run in project costs that would be acceptable?
    - What is the worst net loss that would be acceptable from a catastrophe event?
    - How often would it be acceptable to produce an annual loss?
    - How often would it be acceptable to pay no dividend?
    - How does the board regard the possibility of an adverse front page story in the AFR?

6. **Embed** – Establishing an effective risk management culture and cascading Risk Appetite through the business is crucial to the effectiveness of the regime. This phase should ensure processes are in place for the day-to-day management of risks articulated within the framework.

7. **Monitor and action** – Once the Risk Appetite is defined and embedded, continual monitoring and subsequent actioning, including escalation, is required. Employees should know the freedom in which they can act independently and when and how to escalate. More broadly, maintaining appropriate communication channels across the organisation improves the likelihood of successfully managing appropriately the effects of live and emerging risk events on the organisation. This stage should also include the documentation and recording of historical experience for use in the review phase.

8. **Review and revise** – Regular review of the process will ensure it remains relevant. Further, the drivers and impacts of risk and indeed the risks themselves will change over time. A life insurance entity should consider their

ability to monitor and revise the framework in response to changing circumstances, such as changes in pricing sophistication, developments in technology, evolving regulation or the emergence of new risks.

7.3 Implemented Approaches

A review of the published literature reveals a range of suggested approaches broadly classified as either top-down (commencing the construction of a Risk Appetite Framework from a company-wide level) or bottom-up (where construction commences at a lower level and builds up, such as from product line or business unit levels). Each approach has its advantages and disadvantages as outlined in Figure 17. The implemented approach should be guided by an individual company's assessment of its own core competencies and adherence to key performance measures – there is no prescriptive 'right' or 'wrong' approach to adopt for companies of a certain profile. Outside assessments of Risk Appetite may also favour either approach – external management consultants may be capable of instigating a bottom-up approach, albeit sufficient practical knowledge of the business will be a pre-requisite for this.

Figure 17: Comparison of bottom-up or top-down

	Top-Down	Bottom-Up
Advantages	• Stimulates discussion on risk management at executive and board level • Likely to align with the corporate objectives and future desires • Likely to be clear and articulate • Has support of executive management to proactively embed within organisation • Ensures group-wide view of risk and horizontal consistency in implementation • Mediates views of external stakeholders • Pragmatic and cost efficient	• Granular intricacies of business may only be understood at this level • Very practical and implementable for a particular business unit • Promotes buy-in and an effective risk management culture
Disadvantages	• May be too generic / arbitrary and therefore fail to capture the intricacies of an individual business unit • May not be linked to the day-to-day operations or the risk management system • May restrict decision making at operational level	• May favour the status quo and therefore is less effective at fulfilling strategic objectives • Difficult-to-quantify risks may not be considered properly (e.g. off balance sheet risks) • Different views across business units may be difficult to aggregate

		• May be resource intensive

7.4 A Combined Iterative Approach

Whilst top-down and bottom-up approaches have their merits, a combined approach, where both top-down and bottom-up approaches to setting the Risk Appetite Framework are utilised ensures that emerging risks are captured and enables the governance and decision making framework to consider the different views of all stakeholders. Development of any robust process is driven by experience and the most relevant experience should be consulted for the process to be effective. Relevant experience will occur at all levels. This noted, obviously the Board should be satisfied with the ultimate top-down view of Risk Appetite that it opts to adopt for the organisation.

In practice, linking top-down / bottom-up views of Risk Appetite may be difficult but if successfully achieved will ensure both horizontal and vertical consistency in the framework. The approach will be most successful when there are multiple iterations between the top and bottom until a balance is reached.

Multiple iterations can improve the process. Starting with a simple, less granular scope more aligned to a top-down approach, and subsequently revising over a number of iterations from both perspectives, is likely to achieve more success than trying to implement an all-encompassing framework immediately.

In terms of day-to-day operations, the top-down view from the Board view of the level of risk with which it is comfortable should be cascaded down through the organisation. In this way, management's individual activities will be (or at least they should be) consistent with the Risk Appetite defined by the Board. Therefore, once the firm-wide Risk Appetite has been determined, the aggregate Risk Appetite has to be allocated to the firm's business lines, legal entities, and down to all relevant levels, which need to align with the firm's strategic and business plans. These allocations of Risk Appetite can be assessed against the organisation's actual Risk Profile assessed at de-aggregated levels, as well as at the aggregated level, to provide further insight into actual and desired risk-taking levels within the organisation.

8 EMBEDDING RISK MANAGEMENT

8.1 Risk Management

Risk appetite is a foundational feature of enterprise risk management. A clearly articulated Risk Appetite enables management to determine the types and limits of risk it can take and consequently the levels of risk governance, process and control it should invest in to manage the assumed risks.

There are many definitions of risk and risk management and their relevance to an organisations broader purpose. For this section, let's consider the ISO 31000 description, being that risk management is the 'coordinated activities to direct and control an organisation with regard to risk'.

If risk is the effect of uncertainty of achieving objectives, then Risk Appetite is an expression of the level of that uncertainty a Board is prepared to accept in pursuing their objectives.

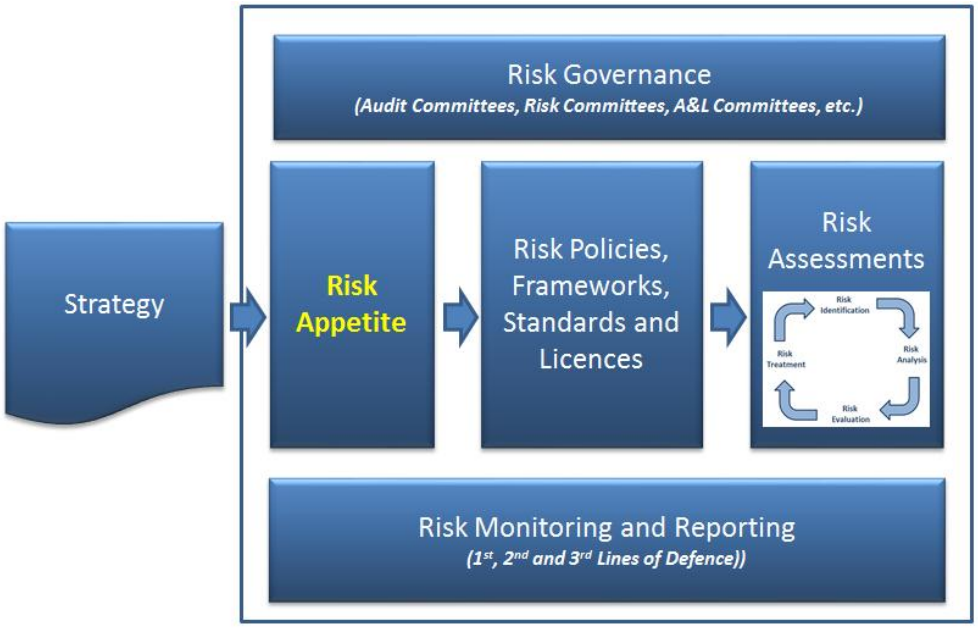
This section explains the relevance of Risk Appetite within the broader context of an organisations enterprise risk management environment and provides guidance into how to effectively 'embed' the Risk Appetite Statement within a business.

8.2 Risk Appetite within the broader Risk Management Framework

APRA CPS 220.30 states that an organisation's Risk Appetite must convey the degree of risk that it is prepared to take in pursuit of its strategic objectives and business plan, in particular defining the maximum level of risk it will operate within for each material risk. CPS 220.32 goes on to state that the organisation's Risk Management Strategy (RMS) should describe material risks and its approach to managing these, including governance, risk roles and procedures for dealing with risk matters.

Figure 18 (below) provides a contextual overview of the role of Risk Appetite within the broader risk management framework.

Figure 18: Risk Management Framework



Risk Appetite should direct and inform the development of risk policies, frameworks, standards and operating licenses. These risk measures and processes should, in turn, support the embedding of the Risk Appetite of the life insurer.

8.3 Embedding and Cascading throughout the Business

Many life insurance employees may have very little interaction with their Risk Appetite Statements and instead use policy and framework documents to understand their operating constraints. This relationship highlights the importance of alignment between the life insurers Risk Appetite and other risk measures as a way of embedding Risk Appetite within a life insurer.

The approach taken by life insurers to cascade Risk Appetite into their organisations can vary widely dependent on many factors, including the corporate culture and the skills-profile of its employees. Figure 19 (below) provides a high level example of some of the mechanisms that insurers can employ to cascade their Risk Appetite.

Figure 19: Risk Appetite Cascading Approach

Risk Category	Embedding mechanism	Risk monitoring and reporting
Market and investment risk	• ICAAP and capital management plans • Market risk polices or investment policies and decision criteria • Investment guidelines and mandates • Investment governance committees (Asset Liability Committees)	• VAR measures • Stress testing and reverse stress testing • Custodial reviews and reporting • Compliance testing of mandates
Credit risk	• ICAAP and capital management plans • Credit risk policy • Wider Investment policies and decision criteria • Investment guidelines and mandates • Investment governance committees (Asset Liability Committees)	• Average credit quality and other credit measures • Custodial reviews and reporting • Compliance testing of credit mandates
Liquidity risk	• Hedging programs • Liquidity Risk Policy • Asset Liability Committees (ALCO)	• Hedge effectiveness tests • Liquidity stress tests

Insurance risk	• Underwriting delegations • Underwriting governance committees • Risk selection and pricing manuals • Reinsurance audits • Product management policies • Claims committees • ICAAP	• Underwriting peer reviews and reports (Quality assessments) • Product and pricing reviews • Capital reporting • 2nd line oversight and challenge of decisions • Scorecards • Movement in EV and VNB
Operational risk	• Unit Pricing Bases and Controls • Delegations of authority • Human capital systems (include performance scorecards and assessment • Operational risk policies and frameworks (e.g. fraud, BCM and outsourcing)	• Unit pricing committees • Balanced scorecards • 1st line of defence QA processes • 2nd line of defence oversight and reporting • Operational incidents and operational losses • Breach reporting
Strategic risk	• Strategic initiatives • Strategic reset • Major projects • Business planning process • Corporate values	• Portfolio review processes • Regular risk reporting • Emerging risks analysis

A life insurer will need to continually ensure an alignment between the RAS and all related controls and processes to ensure gaps don't appear over time between approved Risk Appetite and operational practices. For example, if there were changes to an insurer's strategy in the Group Life market, the insurer could be accepting risk outside its Risk Appetite.

While there is debate over the level of detail to be held within a RAS versus the tools used to embed Risk Appetite within a business, a useful guide may be to consider which of these cascading documents is also Board-approved. An approach which reduces repetition is generally preferred.

An advantage of considering the Risk Appetite at a more granular level is that the assessment of associated risks and the development of controls can be undertaken by specialists in those disciplines. This goes to address the CPS 220.12 requirement that 'appropriate controls are established that are consistent with the institution's risk appetite, risk profile and capital strength, and are understood by, and regularly communicated to, relevant staff'.

8.4 Key Risk Management Processes of which Risk Appetite is a Key Driver

As outlined above, an organisation's Risk Appetite should be one of the principal factors in decision-making. These decision points may exist at a strategic or operational level. Examples of these are:

- **Strategic Level**
  - Strategy development and business planning
  - M&A and new business ventures
  - ICAAP and capital management
  - Risk based capital modelling
- **Operational Level**
  - Operational risk assessments and acceptance of residual risk (i.e. within or outside Risk Appetite)
  - Product pricing
  - People management and performance management

When making strategic-level decisions, such as developing and updating the strategy or undertaking M&A activity, management should ensure that the entity's Risk Appetite is taken into account and certain areas adapted where necessary such that the entity can operate within its Risk Appetite on an ongoing basis.

The entity's Risk Appetite should be incorporated into its ICAAP and the capital modelling including stress testing and capital management processes should highlight situations where the entity might be outside of its Risk Appetite.

The entity's Risk Appetite should be also be reflected at an operational level in areas such as product pricing. This may require the enterprise's Risk Appetite to be defined at a lower level such as for a line of business within the enterprise to which the product pricing relates.

8.5 Monitoring and Reporting

Risk management infrastructure, in particular risk systems, provides an important means of ensuring that an organisation operates within its stated Risk Appetite. This infrastructure is an important means of demonstrating that the Board and senior management have taken the steps necessary to monitor and manage all material risks consistent with strategic objectives, the Risk Appetite Statement and policies (per CPS 220.12).

Risk Reporting should be concise and timely enough to enable management to identify any significant risk management issues that may be emerging in the enterprise and take appropriate actions in order to mitigate these risks.

Management should also ensure that the risk reporting infrastructure is robust and also easy to use to in order to ensure that the reporting of existing and emerging risks is readily available and able to be updated such that the reporting of risk management information is timely.

Figure 20 (below) provides an indicative overview of the role of risk systems in monitoring operational performance within Risk Appetite. The outputs of the risk management processes undertaken (e.g. risk assessments, breach management, and controls assurance) are captured and utilised for a variety of risk oversight and monitoring governance purposes.

Figure 20: Risk Systems

Embedding Risk Appetite in the culture of a life insurer is not a simple exercise and needs to be part of a company wide effort to ensure that the business makes considering risk an integral part of their decision making process.

The Risk Maturity Framework can be thought of in 3 stages:

1. **Early stages –** Controlling Risk
2. **More advanced stages –** Supporting decision making
3. **Advanced stages –** Optimising the capital positions

The early stages of embedding a RAF may be led by the risk management function in collaboration with the teams responsible for the strategic and business plans. Risk may be a constraint to the company's plans. The use of stress testing would help to set expectations and monitor against them.

As the business model matures the RAF becomes more embedded in the life insurer. Risk appetite becomes a more important input to the strategy informing management of the decisions that may optimise the likelihood of delivering the business objectives.

The main way Risk Appetite influences business decisions is through establishing Risk Tolerances and Risk Limits which provide key metrics against which to monitor the risk profile of ongoing operations in the context of adhering to the life company's strategy.

Figure 21: Risk Maturity Frameworks

Early stage **Control Risk**	**More Advanced** **Support decisions**	**Advanced stage** **Optimise capital position**
• Set controls around risk taking and ensuring adequate solvency • **Limits:** Set risk targets based on cascaded limits from the Group position • **Solvency:** capital held and managed to local requirements plus operational buffer • **Business and Control Context** • Cascading would allow risk taking to be controlled at local entity level as well as the Group level • Sets risk targets that provide the basis for risk management activities and monitoring • Limits business risk taking to within the overall Group riks appetite	• Covers aspects of "early stages" RAF • Supports business planning and other decsion making • Facilitates allocation of capital to the most desirable opportunities during the business planning process • Consciously takes account of fungibility constraints/trapped capital • Allows capital to be allocated efficiently throughout the Group • Facilitates allocation of physical capital from less attractive activities to more attractive activities • Identifies key constraints and opportunities to improve capital efficiency	• Covers aspects of "more advanced" RAF • Active optimised allocation of Group capital • Constraints to be addressed as required by e.g. restructuring, internal risk transfer , asset/liability management, product management etc. • Drives economic optimistation through risk selection and structural change • All Group capital benefits from diversification should be captured • Drives all possible capital benefits resulting from internal risk transfers, internal or external leverage and other structural considerations

Source of Figure 21: Graph 5.1.1 Maturity Model of Risk Appetite Implementation (CRO Council and CRO Forum – Risk Appetite- December 2013)

8.6 Implementing a Risk Management Framework

As life insurers implement their risk management frameworks a number of processes need to be implemented with various degrees of difficulty. The below table sets out some examples that are known to have been successful and unsuccessful for life insurers in embedding risk management in their organisations.

Figure 22: What has worked for Life Insurers?

Ease of implementation	Example of successful Risk Framework implementation
Easy	Expectations set by the Board
Moderate	Recognising that different stakeholders have different tolerances; some are more focused on value protection, while others are focused on value creation
	Developing training materials for all levels in organisation • Taking message from Board to employee • Templates for the businesses to follow
	Aligning reporting from the Board, through to a governance committee and then into the performance objectives of the company and its management.
More difficult	Improving risk reporting • Data tailored to the audience and level of granularity • Focusing on material risks • Useful visuals that prompt decision making • Timeliness of the report
	Separating the discussion of fundamental concepts - Risk Appetite, Risk Capacity, Risk Tolerances, Risk Limits etc.
	Incorporating capital allocation within RAS
	Integrating RAS with the strategic & financial plan through linking key drivers with appetite

Even though a number of measures are difficult, time consuming and complex to implement in life insurers they may be beneficial in the risk management practices of life insurance companies.

Figure 23: What has not worked for Life Insurers?

Ease of implementation	Example of unsuccessful Risk Framework implementation
Easy	Focus on risk governance (box –ticking exercise) rather than risk management
	Too quantitative or too qualitative focus
Moderate	Not incorporating the risk management measures into the performance objectives of the company and the management
	Not engaging with the 1st line of the business
More difficult	A very theoretical approach with a focus solely on Economic Capital
	Trying to fit too many risk settings into the RAS – The RAS cannot possibly capture all meaningful risk settings & controls
	Not incorporating the risk management measures into the performance objectives of the company and the management.

APPENDIX A1: DEFINITION OF RISK APPETITE TERMS

In this Paper, the definitions for key risk appetite terms quoted in Section 2 (and referred to throughout the Paper) were chosen after considering the definitions used by APRA and key international organisations. In this Appendix, these definitions are listed and the background to the selections is documented.

We have tended to opt for the definitions advocated by the **Financial Standards Board (FSB)**[10] if they are considered to be appropriate. The FSB coordinates at the international level the work of national financial authorities and international standard setting bodies, and develops and promotes the implementation of effective regulatory, supervisory and other financial sector policies in the interest of financial stability. The FSB's paper is relatively recent (November 2013).

We have also considered definitions also recently proposed by the **CRO Forum and the North American CRO Council**[11]. The CRO Forum member companies are large multi-insurance national companies headquartered across the world with a concentration in Europe. The CRO Council is a professional association of Chief Risk Officers of leading insurers based in the United States, Bermuda and Canada.

While APRA does not propose definitions for all risk appetite terms in **CPS 220**, or elsewhere, where terms are defined they are generally similar to those of the FSB.

The **Institute of Risk Management** provided definitions of risk appetite terms in September 2011[12].

Figure 24: Risk Appetite definitions

Source	***Definition***
CPS 220	The degree of risk that the institution is prepared to accept in pursuit of its strategic objectives and business plan, giving consideration to the interests of depositors and/or policyholders *(paragraph 30(a))*
Institute of Risk Management	The amount of risk that an organisation is willing to seek or accept in the pursuit of its long term objectives.
Financial Stability Board	The aggregate level and types of risk a firm is willing to assume within its risk capacity to achieve its strategic objectives and business plan.
CRO Forum	A company's risk appetite establishes boundaries for the aggregate level or types of risk a company is willing to assume in order to achieve its business objectives.
Selected for this paper	The aggregate level and types of risk an institution is willing to assume, or avoid, within its Risk Capacity to achieve its strategic objectives and business plan.

[10] "Principles for An Effective Risk Appetite Framework", FSB 18 November 2013
[11] "Establishing and Embedding Risk appetite: Practitioners' View", CRO Forum December 2013
[12] "Risk Appetite and Tolerance Guidance Paper", The Institute of Risk Management September 2011

CPS 220: By mentioning only "depositors and/or policyholders", it however excludes other relevant stakeholders such as regulators, shareholders, debt holders, employees and potentially the broader community. Reference to business plan is suitable only if the Risk Appetite Statement is reappraised at the same time the plan is being framed.

FSB: Reference to business plan is suitable only if the Risk Appetite Statement is reappraised at the same time the plan is being framed.

Figure 25: Risk Capacity definitions

Organisation	***Definition***
CPS 220	Not defined
Institute of Risk Management	Not defined
Financial Stability Board	The maximum level of risk the financial institution can assume given its current level of resources before breaching constraints determined by regulatory capital and liquidity needs, the operational environment (e.g. technical infrastructure, risk management capabilities, expertise) and obligations, also from a conduct perspective, to depositors, policyholders, shareholders, fixed income investors, as well as other customers and stakeholders.
CRO Forum	The maximum level of risk a company can assume before it breaches regulatory constraints (e.g. breach of solvency or liquidity ratios) or other stakeholders' constraints (e.g. inability to fulfil pension scheme obligations).
Selected for paper	The maximum level of and type of risk an organisation is able to support before breaching constraints determined by regulatory capital and liquidity needs and its obligations to customers, shareholders and other stakeholders.

Figure 26: Risk Appetite Framework (RAF) definitions

Organisation	***Definition***
CPS 220	Not defined
GPS 220	"includes systems (including the structures, processes, policies and roles supporting them) for identifying, assessing, mitigating and monitoring the risks that may affect a regulated institution's ability to meets its obligations to policyholders" *(paragraph 7(a), applicable*

	until 31 December 2014)
Institute of Risk Management	Not defined
Financial Stability Board	The overall approach, including policies, processes, controls, and systems through which risk appetite is established, communicated, and monitored. It includes a risk appetite statement, risk limits, and an outline of the roles and responsibilities of those overseeing the implementation and monitoring of the RAF. The RAF should consider material risks to the financial institution, as well as to the institution's reputation vis-à-vis policyholders, depositors, investors and customers. The RAF aligns with the institution's strategy.
CRO Forum	The framework of policies and processes that establish and monitor adherence to the company's risk appetite.
Selected for this paper	The framework describes the overall approach (including policies and processes) through which Risk Appetite is established, communicated and adherence to the institution's Risk Appetite is monitored.

Figure 27: Risk Appetite Statement definitions

Organisation	*Definition*
CPS 220	Not defined
Institute of Risk Management	Not defined
Financial Stability Board	The articulation in written form of the aggregate level and types of risk that a financial institution is willing to accept, or to avoid, in order to achieve its business objectives. It includes qualitative statements as well as quantitative measures expressed relative to earnings, capital, risk measures, liquidity and other relevant measures as appropriate. It should also address more difficult to quantify risks such as reputation and conduct risks as well as money laundering and unethical practices.
CRO Forum	Establishes boundaries for the aggregate level or types of risk a company is willing to assume in order to achieve its business objectives. Risk appetite may have multiple qualitative and quantitative dimensions, resulting in multiple ways of expressing risk appetite. Risk appetite statements reflect the combination of risk acknowledgment, including preferences to and unacceptability of specific risks, and company-wide tolerances for those risks. In its most general form, a risk appetite would describe the pertinent risks to which the company is exposed and the amount of exposure it is willing to assume from those sources of risk.
Selected for this paper	The articulation in written form of the aggregate level and types of risk that a firm is willing to accept, or to avoid, in order to achieve its business objectives. It includes qualitative statements as well as quantitative measures expressed relative to earnings, capital, risk measures, liquidity and other relevant measures as appropriate. It should also address more difficult to quantify risks such as reputation and money laundering, as well as business ethics and conduct.

Figure 28: Risk Tolerance definitions

Organisation	*Definition*
CPS 220	For each material risk, the maximum level of risk that the institution is willing to operate within, expressed as a risk limit and based on its risk appetite, risk profile and capital strength. *(paragraph 30(b))*
Institute of Risk Management	The boundaries of risk taking outside of which the organisation is not prepared to venture in the pursuit of its long term objectives.
Financial Stability Board	Not defined
CRO Forum	The quantitative measures and qualitative assertions for the maximum risk allowed by the appetite. Risk tolerances are typically set at the enterprise/group level. *(paraphrased from paper)*
Selected for this paper	Risk Tolerances are the quantitative measures and qualitative assertions for the maximum risk allowed by the appetite. Risk tolerances are typically set at the enterprise level.

CPS 220: 'Risk limits' are generally used for operational purposes.

Figure 29: Risk Limit definitions

Organisation	*Definition*
CPS 220	Not defined
Institute of Risk Management	Not defined
Financial Stability Board	Quantitative measures based on forward looking assumptions that allocate the financial institution's aggregate risk appetite statement (e.g. measure of loss or negative events) to business lines, legal entities as relevant, specific risk categories, concentrations, and as appropriate, other levels.
CRO Forum	Measurements based on forward-looking assumptions that cascade the company's aggregate risk tolerances to lower levels of granularity. For many companies, risk limits provide operational controls at the level of the organisation that manages the risk on a day-to-day basis.
Selected for this paper	The restrictions prescribed by an institution on its business activities, designed to constrain overall risk taking within the Risk Tolerances established in the Risk Appetite Statement. Risk Limits are operational in nature and serve to cascade the Risk Tolerances (contained in the Risk Appetite Statement) into practical constraints on business activities.

Figure 30: Risk Profile definitions

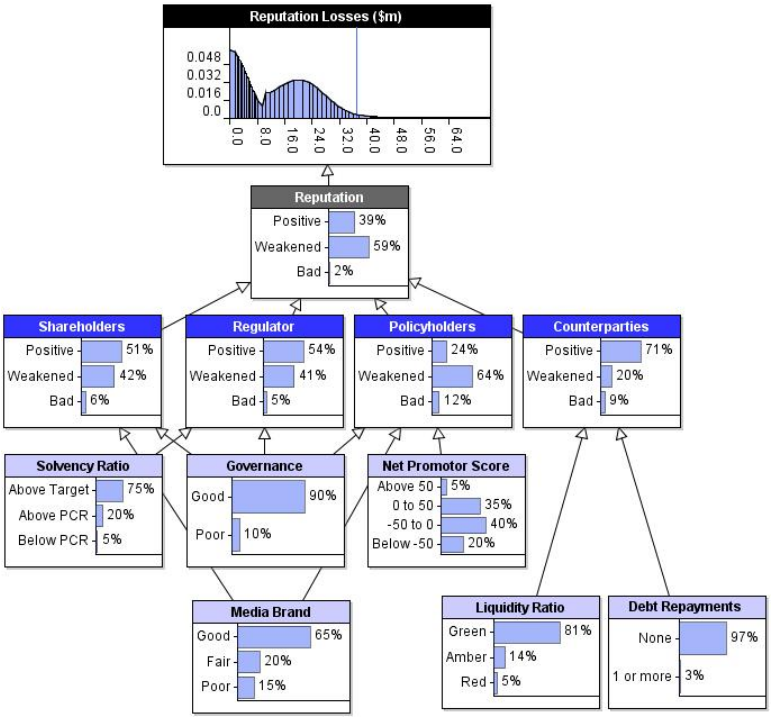
Organisation	*Definition*
CPS 220	Not defined
Institute of Risk Management	Not defined
Financial Stability Board	Point in time assessment of the financial institution's gross and, as appropriate, net risk exposures (after taking into account mitigants) aggregated within and across each relevant risk category based on forward looking assumptions.
CRO Forum	A company's risk profile is a point-in-time assessment of risk exposures, expressed in relation to risk limits, risk tolerances, and risk capacity.
Selected for this paper	An institution's risk profile is a point-in-time assessment of risk exposures, expressed in relation to Risk Limits, Risk Tolerances, and Risk Capacity.

APPENDIX A.2: CASE STUDY

A.2 Example of Testing Risk Limits via a Bayesian Network

Consider the reputational risk example as discussed in Figure 15. As mentioned, the first step is to define the states of each of the variables that causally describe the risk. These are shown below.

Figure 31: A Bayesian Network model of reputation risk. Source: Milliman using Agena Risk software



In this Figure, the various risk indicators have state definitions that correspond to those in which the business thinks about and communicates in. The boundary condition between each state typically represents a non-linear tipping point through which the consequences change. For example, having a solvency ratio dip below x% of the targeted level of required capital (the Prescribed Capital Requirement – PCR) will trigger actions by the Board, management and the regulator to address the issue, which in turn will have an impact on how the regulator assesses the strength of the organisation, and hence its reputation of them. Debt repayments might have a single tipping point whereby even if a single payment is missed, it has significant reputational impacts amongst counterparties.

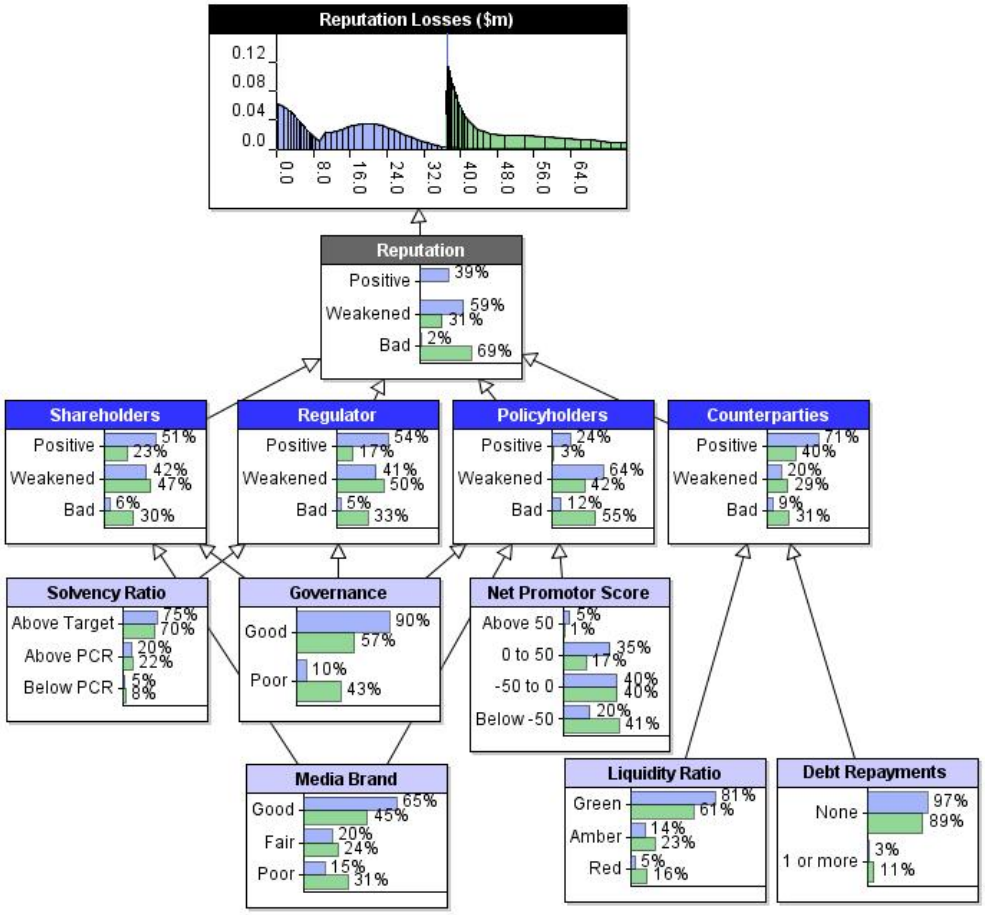
The next step is to codify the relationships between the variables. These are dependent upon how the states themselves have been defined, as we typically use different adjectives to communicate different causal dynamics. In the example above, most of the dependent relationships are modelled as truncated normal distribution with means that are weighted averages of those of the underlying variables, and variances that reflect the uncertainty in the relationship. Note that these are purely indicative only for the purposes of this case study – in reality they will vary by organisation, as will the risk variables themselves. In this example, the order of most to least important stakeholder reputation used is policyholders, regulator,

counterparties, and then shareholders. Other weight mechanisms could be justified, including the use of more complex non-linear dependencies, although this is sufficient for the purposes of this case study.

Finally, an indicative prior distribution for each risk indicator has been set. For example, the likelihood of media brand being in good, fair and poor states over the coming period (say 12 months) has been assessed to be 65%, 20% and 15% respectively. This calibration could be made using any combination of analytics on historic data, expert judgment, or anecdotal evidence. As it is meant to be forward looking, it will almost certainly involve some degree of judgment. However this should not be shied away from but rather embraced, as there is significant value to this information, not just to the risk manager, but to the business more generally as it is what business managers are using in reality to achieve their operational objectives and manage risk.

The result of this information is a distribution of expected losses due to reputation risk, as shown in the top graph in the following figure. The vertical line in this graph represents the 97.5th percentile result, which is a $37 million loss. Now consider the situation where a Risk Tolerance is set at this level for reputation risk. It is now possible to determine what combination of states of the underlying risk indicators are consistent with outcomes that are at this level. Formally this is achieved by setting a constraint on the model such that outcomes have to be in excess of this limit, and using the Bayesian inference properties of the model to reverse stress test this. The results of this are shown below.

Figure 32: Cascading a reputational Risk Tolerance to limits on risk indicators using Bayesian inference in a Bayesian Network. The blue represent the base scenario, whilst the green represents the reverse stress test results. Source: Milliman using Agena Risk software



Working from the top down, reputational losses are conditioned to be at least $37m, resulting in the skewed distribution shown, with a peak starting at the $37m mark. In order to achieve these outcomes, not surprisingly, reputation has deteriorated significantly, with the chance of having a bad reputation increased from only 2% to 69%. Notably, it is not possible to breach Risk Tolerance with any chance of reputation being in a positive state. This is an important intuitive check.

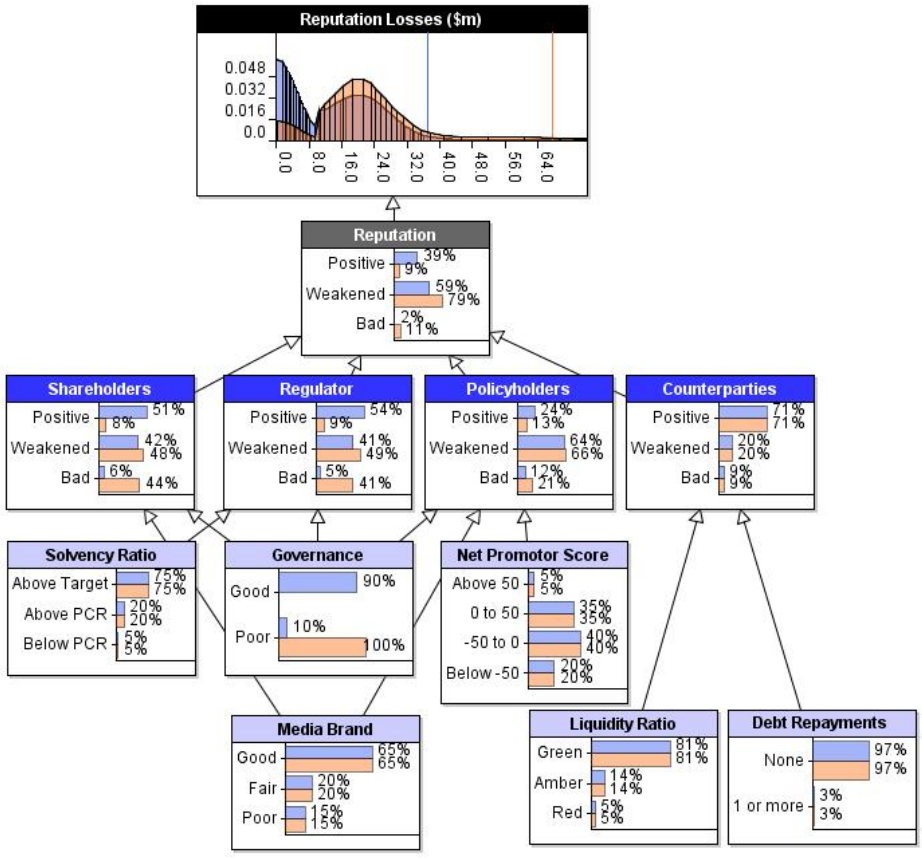
Looking at the next layer down, it is possible to now see the most likely causes of the decline. Policyholder reputation has deteriorated significantly, with there now being a 55% chance of it being in a bad state. Whilst the reputation amongst other stakeholders has also deteriorated, there is still a material chance that each of these could still be in a positive state (23%, 17% and 40% respectively). This formally shows that it is possible to still breach Risk Tolerance without reputation moving out of a positive state with these stakeholders. Hence any attempt to put a Risk Limit on these items (shareholders, regulator, counterparties) that states that we will be in breach of Risk Tolerance if their reputation is not in a positive state, will be incorrect and misleading. If done this way, then these risks may still be well within their limits whilst the manager is staring at a massive reputational crisis amongst policyholders. This is the problem with using simple heuristics when dealing with complex risk

dynamics – they often underestimate the less extreme / moderate multivariate stresses that breach Risk Tolerance.

Moving down further into the risk indicators presents even more useful information. The likelihoods shown by the green bars represent the minimum Risk Limits that are consistent with overall Risk Tolerance. The largest impact is on governance, the likelihood of it being in a bad state having increased significantly from 10% to 43%. The latter thus represents the formal Risk Limit for this risk indicator, below which it is not possible to breach Risk Tolerance. Similarly, the likelihoods associated with the worst states for the other risk indicators represent the Risk Limits consistent with the Risk Tolerance levels.

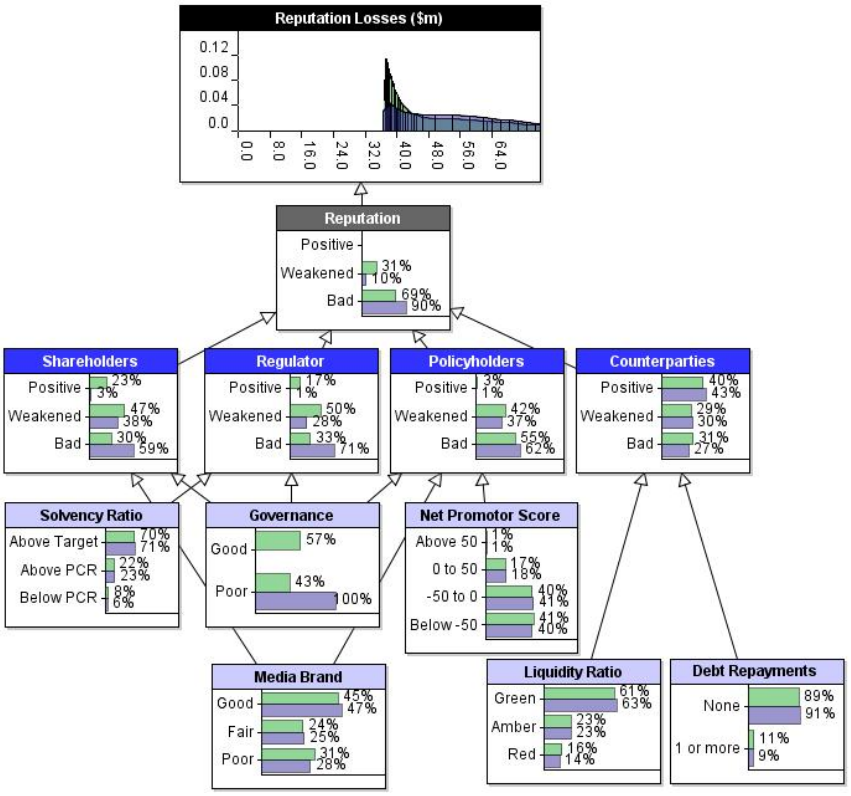
Breaching these Risk Limit levels does not guarantee that overall Risk Tolerance will be breached. This is because of the interdependent nature of the risks. An example of this is shown in the following Figure, whereby a governance failure is represented by a 100% likelihood of being in a poor state.

Figure 33: Stress test involving a governance failure. Source: Milliman using Agena Risk software



As can be seen, a governance failure has materially worsened the likelihoods of the states of overall reputation and consequent losses, but not to the point where a loss in excess of $37m is guaranteed. Instead it has increased the likelihood of a loss greater than this from 2.5% to 11%. What it has done however is increase the sensitivity of the other risk variables, such that their risk limits under this environment have now materially reduced.

Figure 34: Cascading a reputational Risk Tolerance to Risk Limits, under an already failed governance environment shown in purple. The original Risk Tolerance breach scenario is also shown in green for comparison purposes. Source: Milliman using Agena Risk software



The above figure shows that when a governance failure has occurred, the Risk Limits for other risk indicators has correspondingly reduced. For example, the likelihood of the solvency ratio being below the PRC has reduced from 8% to 6%. This highlights an important risk dynamic – that tail risk events occur primarily as a result of a combination of stresses, rather than due to a single causal factor. A stress in one risk factor typically sets up the conditions for smaller stress in other risk factors to breach risk tolerance. This also gives rise to an important conclusion: whilst Risk Tolerance levels can be set statically, Risk Limits should in fact be dynamic, responding constantly to the evolving risk landscape.

APPENDIX A.3: REFERNCES

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