Risk Management in South African Life Insurance Companies

Marli Venter

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ABSTRACT

There are currently many factors driving an increased formal focus on risk management within insurers. Risk management in insurers is particularly important as the interests of policyholders and shareholders need to be balanced.

Small insurers, in particular, have problems that larger offices do not always share and risk management is therefore almost more important in the smaller companies that have fewer resources to dedicate to it.

The purpose of the study was to establish the risk management practices of life insurers in South Africa and also to compare the practices of small and large insurers.

DECLARATION

I declare that this research report is my own unaided work; it is submitted in partial fulfilment of the requirements of the degree of Master in Business Administration in the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in any other University.

Marli Venter
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DEFINITION OF TERMS

Life insurance: Long term insurance e.g. life assurance, annuities, funeral and investment or savings policies. It does not include short term insurance such as household and motor insurance usually called general insurance. (Benfield, 2004)

Reserves: "Reserves" refers to the actuarial liabilities or policyholder reserves. In its simplest form, this is the net present value of the expected future claims, allowing for expenses and premiums still due, from the policies on the books of the company. (Benfield, 2004)

1 INTRODUCTION

The purpose of the study was to establish the risk management practices of life offices in South Africa.

1.1 Balancing shareholder and policyholder interests

As King (2002) states, “Enterprise is the undertaking of risk for reward”. There is no reward without risk. Managing risk is difficult enough when only shareholders need to be considered. Insurers, however, must also consider policyholders who have very different risk concerns to shareholders. Policyholders are mainly concerned with the solvency of the company, whilst shareholders’ concern is the return on their investment. Policyholders’ interests can be enhanced by holding excess capital, but this needs to be balanced with the return given to the shareholders (Tillinghast, 2002b).

The insurance regulators look after the interests of the policyholders. Different regulators have different objectives, but most regulators’ objectives include maintaining confidence in the financial system and providing appropriate protection of consumers’ rights. In addition, regulators may have different approaches to insurer failure – some aiming for a zero failure rate, whilst others aim for a balance between preventative measures and market freedom (London Working Group, 2002).

1.2 Focus on risk management

There are many factors driving the increased formal focus on risk management within insurers. These include new corporate governance standards, industry problems and risk based capital requirements.

In 2002, the King Committee released their report on Corporate Governance. In terms of the report, “the board has responsibility to ensure that the company has implemented an effective ongoing process to identify risk, measure its potential

impact against a broad set of assumptions, and then activate what is necessary to pro-actively manage these risks." (King Committee, 2002: 74)

Recent problems are also forcing insurers internationally to review their risk management processes and methodologies. Whilst overseas insurers are struggling with a tough global economy and increases in regulation following reporting scandals and insolvencies, South African life insurers are facing a different set of, mainly reputation related, problems. Recent rulings by the Pension Funds Adjudicator (Bridge-David, 2005) and research on the costs of retirement annuities (Rusconi, 2005) have reduced public confidence and National Treasury has announced that it will be investigating high costs and low levels of competition (National Treasury, 2006).

Risk management is a fast changing area. The Basel committee on Banking Supervision published their first proposals in 1999 and there have been significant developments since then (Basel Committee on Banking Supervision, 2005). The approach taken is a three pillar approach as follows:

- Pillar 1: Minimum capital requirements, which can be calculated on a standard basis or using the bank's internal risk models if specified criteria are satisfied.
- Pillar 2: Supervisory review process which is intended to ensure that banks have adequate capital for their risks, but also to encourage banks to develop and use better risk management techniques.
- Pillar 3: Market discipline aims to provide sufficient disclosure to allow market participants to understand the risk and capital adequacy of a bank.

However, insurance business is based on accepting a premium to provide protection on the occurrence of a specified event. Insurance liabilities are therefore subject to significant uncertainty and significantly more uncertainty than in banks. Banking risks occur mainly on the asset side whilst insurance companies have risks on both the asset and liability side of the balance sheet. (von Bomhard, 2005)

Due to this complexity, it is not possible to simply follow the well-developed banking principles, but it is all the more reason to have good risk management principles in place. Insurance regulators, including South Africa, are (and have been) introducing similar risk based principles into their capital requirements. In contrast to banking, however, there is no industry standard.

Economic capital, using risk based principles and companies' internal models, is often calculated to be significantly higher than the regulatory capital required. This result is surprising and could be due to a high level of caution, but should be concerning from a regulatory point of view. (KPMG, 2004)

1.3 Small insurers

Small insurers, in particular, have problems that larger offices do not always share. Smaller companies have smaller portfolios and more volatile claims experience. They have less opportunity to diversify as they are usually niche insurers. They also do not share the same access to resources as their larger counterparts. Risk management is therefore almost more important in the smaller companies that have fewer resources to dedicate to it.

2 OBJECTIVE OF THE RESEARCH

2.1 Objectives

The purpose of the research was to determine the risk management practices of life offices in South Africa. The objectives can be further described in terms of the following sub-problems.

The first sub-problem was to determine the current risk environment.

The second sub-problem was to determine the current risk identification practices.

The third sub-problem was to determine which risks the companies monitor and consider the most important.

The fourth sub-problem was to determine the current risk assessment practices of the companies.

The fifth sub-problem was to determine the current risk responses to and control activities for the most important risks.

The sixth sub-problem was to determine the internal risk reporting and monitoring practices.

The seventh sub-problem was to determine whether there are any differences between the risk assessment, risk management and risk disclosure practices in small and large life insurers.

2.2 Delimitations

The study was limited to the risk assessment and risk management practices of the life insurers. Risk based capital and/or the use of economic capital was only explored to the extent that some companies may be using it as a risk management measure. The relationship between risk management and capital management and therefore shareholder value was also specifically excluded.

The risk management objectives of the companies were not explored. It was assumed that companies manage their risk even if only for governance purposes.

The study only considered the ongoing South African operations of the insurers. Risks arising from international operations, parent companies and/or mergers and acquisitions were not included.

Reporting in the study was limited to internal reporting. Shareholder disclosure and regulatory disclosure were only included to the extent that companies use the same measures for their internal reporting.

3 LITERATURE REVIEW

3.1 Introduction

The literature review describes the previous research and theory related to the research problem (Leedy and Ormrod, 2001). In this review, section 3.2 sets out some background information on the risk management process. In section 3.3 the internal risk environment is discussed. In section 3.4 the literature on how risks are identified and measured is covered. In section 3.5 the important risks are identified, section 3.6 covers measurement and in section 3.7 the possible responses to risks are discussed. Section 3.8 sets out the literature on internal reporting and monitoring and in Section 3.9 the special problems within small insurers are discussed.

3.2 Background discussion

3.2.1 Risk management process

The Committee of Sponsoring Organisations of the Treadway Commission issued a framework for enterprise risk management to assist managers in the United States with complying with strengthened regulations on corporate governance and risk management (COSO, 2004). Ballou & Heitger (2005) uses this framework to present a practical approach for implementation as follows:

1. **Internal environment**: Included in this step is the development of a risk management philosophy, creating a risk culture and designing a risk management organisational structure.

2. **Objective setting**: Establish the strategic objectives and strategies and determine the risk appetite for the company.

3. **Event identification**: Identify the risk events and consider event interdependencies.
4. **Risk assessment**: Select an assessment technique, assess the inherent probability and/or frequency of the risk events and assess the cost impact of the risk events.

5. **Risk response**: Identify and select responses to each risk, consider the effects of the responses on other risks and adjust risk assessments for any risk avoidance and/or acceptance made.

6. **Control activities**: Assess costs for shared risks i.e. those insured. Identify control activities and costs to reduce risks and adjust risk assessments after risk sharing or controls have been put in place.

7. **Information and communication**: Ensure that information systems can measure and report risk and communicate risk management effectiveness and costs.

8. **Monitoring**: Perform risk evaluations, re-evaluate previous risk assessments and consider areas to expand the risk management framework.

The framework can be summarised in the following model.

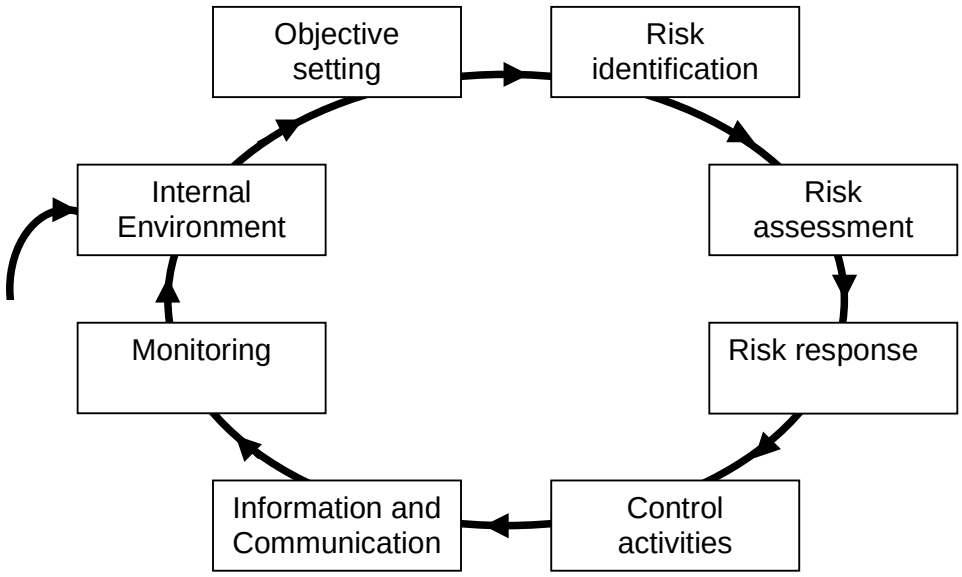

Figure 1: Risk management process

3.2.2 Prior studies

Several studies, focussing on slightly different aspects, have been done by service providers internationally (Bartlett et al., 2005, SoA Risk Management Committee, 2005, Ernst & Young, 2004, KPMG, 2004, PwC, 2004, Tillinghast, 2006, Tillinghast, 2004, Tillinghast, 2002a). Some of these studies included South African insurers. Dardis (2002) completed a study of South African companies.

The results of the prior studies show interesting trends, but they are not representative of the industry. In almost every case, the participants are specified as leading insurers, top 100 companies or something similar. The study done by the Faculty and Institute of Actuaries (Bartlett et al., 2005) included smaller

companies and showed differences between smaller and larger insurers in the appointment of a Chief Risk Officer and reporting to the board.

The following are the most important findings from the prior studies:

- Enterprise Risk Management is gaining attention and the position of the Chief Risk Officer has gained both in seniority and responsibility as companies have realised the value of risk management. In most companies, the person responsible for risk management now reports to the Chief Executive Officer and many companies have appointed a Chief Risk Officer (SoA Risk Management Committee, 2005, Tillinghast, 2006). Very few companies, however, have gone far in integrating their risk and capital management with their performance management and management compensation (PwC, 2004).

- Insurers have made significant progress towards implementation of a fully functioning risk management framework, but most companies are still in the process of improving their basic risk management processes (Tillinghast, 2006). Challenges in implementation include the need for data, a lack of resources, inadequate information systems and cultural acceptance from staff (Bartlett et al., 2005, PwC, 2004).

- Risk management practices are changing rapidly and they can be expected to continue to do so. There is currently no standard methodology and techniques continue to evolve (Tillinghast, 2004, Ernst & Young, 2004).

- Insurers are starting to acknowledge that risks are not independent. However, they do not yet fully understand how risks interact and few allow for risk aggregation in their models (Tillinghast, 2004, PwC, 2004, KPMG, 2004).

- Insurers find it difficult to quantify operational risks i.e. risks inherent in business processes, operating systems and the performance of individuals. Most operational risk management initiatives launched were to reduce

potential operational losses rather than a desire to strengthen controls over financial reporting (Tillinghast, 2004, PwC, 2004).

- Insurers view risk management more as regulatory compliance than an integral part of the business. Many companies are still not sure that a sophisticated risk and capital framework is a worthwhile endeavour. There are divided opinions on the value of more transparency and disclosure (PwC, 2004) and economic capital, where calculated, is often calculated as being significantly higher than regulatory capital (KPMG, 2004).

3.3 The internal risk environment

The responsibility for risk management, the risk management function, the risk management policy and the risk culture are included under the risk environment.

3.3.1 Risk management responsibility

According to AIRMIC, ALARM & IRM (2002) the board has responsibility for determining the strategic direction of the organisation and for creating the environment and the structures for effective risk management. This may be through an executive group, a non-executive committee, an audit committee or such other function that suits the organisation's way of operating and is capable of acting as a 'sponsor' for risk management. King, (2002) requires the board to show that they have dealt with risk management and internal control.

Management is responsible for the implementation (King Committee, 2002). The business units have primary responsibility for managing risk on a day-to-day basis (AIRMIC et al., 2002).

The role of Internal Audit will differ from company to company and could include some or all of the following functions (AIRMIC et al., 2002).

- Auditing the risk management process and focussing internal audit work on the significant risks.
- Providing assurance on the management of risk.
- Providing active support and involvement in the risk management process.
- Facilitating risk identification and assessment and the education of staff.
- Coordinating the risk reporting.

King (2002) warns that Internal Audit should not assume the risk management function. They should be used to provide independent assurance to the board.

3.3.2 The risk management function

Risk management structures vary from formal to informal. In a formal structure a senior manager is charged with the management of all risks. In an informal structure, management assume that line managers will manage the risks in the functions and departments they are charged with. (Smallman, 1996)

Risk management structures can also be centralised or de-centralised. In a centralised structure all risks are analysed and controlled in one department whereas in a decentralised structure, the risks belong to the departments. (Smallman, 1996)

Ernst & Young (2006) investigated the factors considered necessary for successful risk management. They identified ownership, understanding throughout the organisation and communication as the most important success factors. Neither a dedicated risk function nor a centralised approach was identified as a high priority for success. They consider it important to distinguish between a centralised approach and a process that is integrated and aligned.

The risk management function may range from a risk champion or part time risk manager to a full scale risk management department (AIRMIC et al., 2002).

According to (AIRMIC et al., 2002) the role of the Risk Management function should include setting the policy and strategy for risk management, building a risk awareness within the organisation, designing and reviewing the risk management processes, developing risk responses and co-ordinating the reporting.

3.3.3 Risk management policy

An organisation's risk management policy should set out its approach to and appetite for risk as well as its approach to risk management. The policy should also set out responsibilities for risk management throughout the organisation. (AIRMIC et al., 2002)

In terms of King (2002), the board must define the company's appetite or tolerance for risk. A major benefit of defining risk appetite is that it forces debate and helps ensure that risks are made explicit (Barfield, 2005). Managers are well aware of the importance of strategy formulation. However, the definition of risk is usually not formalised and management can not ensure consistency throughout the company (Noy and Ellis, 2003). In defining the risk appetite, a company will achieve clarity over the risks it wishes to assume, a basis for consistent communication to the different stakeholders and a clear expression of the attitudes to risk of the senior management. (Barfield, 2005)

Barfield (2005) however, also states that before appetite can be considered, the company's risk capacity needs to be considered.

3.3.4 Risk culture

Risk management should be the responsibility of every employee (King Committee, 2002). Ballou & Heitger (2005) state that there are two necessary requirements for the creation of an effective risk management culture:

1. an awareness of the risk appetites of key stakeholders and
2. a commitment to align the company's strategic objectives and initiatives with the risk appetites of the key stakeholders.

According to AIRMIC et al. (2002), risk management must be made an integral part of the company through the strategy and budget processes. It should be covered in the induction programme, all training and all the operational processes.

Culture shifts take time. Initially many employees will view the introduction of formalised risk management as just another corporate fad (Ballou and Heitger, 2005). A key challenge is to check if the risk appetite of the organisation is consistent with the risk appetite of the staff. A poor match can cause confusion and stress within employees (Kendrick, 2004).

It is also important to establish how risks could be dealt with by staff. Do they need a set of competencies or is the creation of an awareness good enough? (Kendrick, 2004) Staff incentives also need to be aligned to support the right behaviour (LOMA, 2001).

3.4 Identification of risks

In this section the different ways in which insurance companies identify risks are discussed.

3.4.1 Risk identification

King (2002) requires that an assessment of the processes and outcomes around key risks be undertaken and documented at least annually.

Risks can not be controlled if they are not recognised. The management team may often be too inexperienced to perceive a risk and therefore may not get the expertise required to control the risk (Allen, 2003). Techniques that could be used to broaden the reach, candour and quality of the risk assessment input include:

- Surveys – Anonymous surveys increase the candour.
- Workshops – Workshops have the additional benefits of creating awareness and improving communication within the company.
- External assistance and/or benchmarks. (Ernst & Young, 2005)

Organisations need to carefully create risk categories and consider how risks can occur (Ballou and Heitger, 2005). There are many ways of classifying risks. The FSA rules (FSA, 2003) in the UK classify risks into: market risk, credit risk, liquidity risk, insurance risk, operational risk and group risk.

Risks can also be classified by cause and effect. The effects are usually more obvious. The London Working Group of the Conference of the Insurance Supervisory Services of the Member States of the European Union (London Working Group, 2002) studied not only the effects of risks, but also the causes and developed the following model:

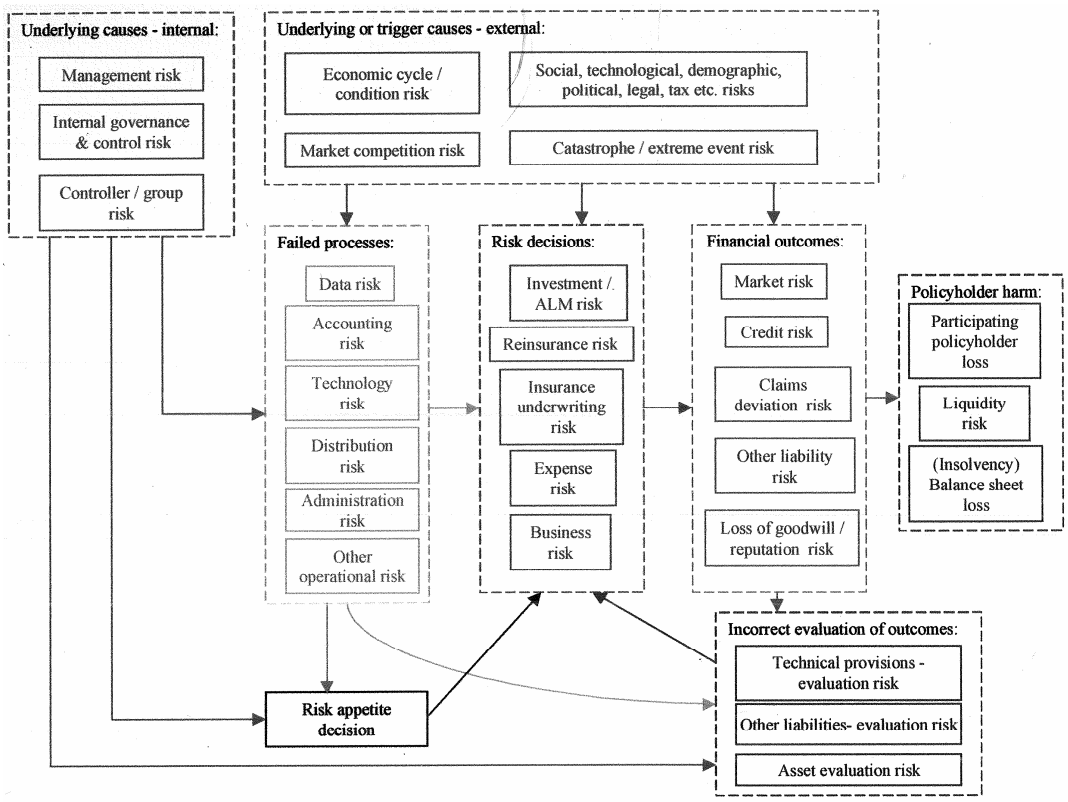

Figure 2: Detailed Risk Map

Another classification is according to asset, liability, asset/liability and operational risks (Britt et al., 2002).

3.5 Insurance company risks

In this section the risks that insurance companies face are discussed as well as which risks are considered more important.

3.5.1 Risk descriptions

In a study by (KPMG, 2002) in response to a request from the European Commission the following classification of risks is suggested:

- Risks arising at the company level.
- Systematic risks – Risks that are influenced by factors that affect the whole industry.
- Systemic risks – Risks that are related to local or global economic or social factors that will indirectly have an impact on the insurance industry. It is unlikely that the insurance company is able to influence events but it may be in a position to manage the risks.

The following table summarises the main risks faced by insurers using the classification suggested by (KPMG, 2002). The list is not exhaustive and different companies will have different exposures to the different risks.

Table 1: Risk descriptions

Risk	Description
Company level	
Market and product strategy	The risk of selling the wrong product to the wrong customers through the wrong channels. Good financial management will not protect an insurer against losing revenue if it is products are inadequate (LOMA, 2001)

Risk	Description
Distribution	The risk of inadequate control over distribution systems (London Working Group, 2002)
Reputation	The risk of any event that results in a negative perception of the company by customers, distributors and any other important business constituencies (LOMA, 2001)
Pricing inadequacy	Includes persistency, mortality and morbidity as well as expense risk (LOMA, 2001)
Persistency	The risk that fewer policies than expected stay on the books (Benfield, 2004)
Mortality & morbidity	The risk that death and/or disability claims are greater than expected (Benfield, 2004) Risks arise from new illnesses, medical innovations, anti-selection e.g. genetic testing, possible government intervention to limit insurer's ability to classify risks, catastrophic events due to concentration risks. (LOMA, 2001)
Expenses	The risk of failure to control or predict expenses. (LOMA, 2001)

Risk	Description
Credit	The risk of default where an individual, company or government fails to honour a promise to make a payment (Marrison, 2002). This includes reinsurers, distributors, derivative counter-parties as well as normal assets (LOMA, 2001).
Liquidity (trading)	The risk that an asset can not be sold quickly at a fair price (Marrison, 2002)
Liquidity (funding)	The risk that the institution will run out of cash to pay its debts (Marrison, 2002)
Operational	The risk of direct or indirect loss resulting from inadequate or failed internal processes, people and systems or from external events (Basel Committee on Banking Supervision, 2005)
Human resources risk	The risk that staff members lack the skills or experience to enable them to perform their tasks adequately and successfully. This includes over-reliance on one or more persons (London Working Group, 2002)
Internal governance and control risk	The risk of inadequate or failed systems of corporate governance or internal control, including the risk that arises from an inadequate control culture (London Working Group, 2002)

Risk	Description
Group risk	The risk of inadequate or inappropriate direction, control or influence from connected persons, natural or corporate (London Working Group, 2002)
Reinsurance	The risk that an inappropriate reinsurance strategy is adopted or that the chosen reinsurance strategy is inadequately implemented (London Working Group, 2002)
Asset/Liability Management	Risk that an inappropriate investment strategy is adopted or that the chosen investment strategy is inadequately implemented (London Working Group, 2002)
Reserving	
Technical reserves	The risk that the technical reserves may not be sufficient (London Working Group, 2002)
Recognition	The risk of non-recognition, under recognition or delayed recognition of liabilities (London Working Group, 2002)

Risk	Description
Systematic risks	
Jurisdictional and legal	The risk of court decisions and/or regulation (including taxation) having implications for policyholder liabilities. (KPMG, 2002)
Market changes	The risk of changes in consumers' attitude and competitor behaviour (KPMG, 2002)
Catastrophe	The risk of a sudden unexpected, unavoidable and severe event causing an extraordinary loss (Benfield, 2004)
Systemic risks	
Market risk	The possibility of losses resulting from unfavourable market movements (Marrison, 2002)
Economic risk	The risk of adverse change in the economy including changes in variables such as interest, inflation and exchange rates (London Working Group, 2002)
Social, Technological, demographic and political changes	The risk of changes in the social, technological, demographic or political environment (London Working Group, 2002)

3.5.2 Relative importance of risks

Due to the number of risks, it is vital that a company initially focuses on the material risks. These are the risks that can have a material effect on the financial performance or strategy development of the company. (Tillinghast, 2002b)

Several studies have been done to determine the more important risks and the results have not always been consistent. Deloitte. (2005) showed that some of the greatest losses in shareholder value were caused by low frequency, high impact events. KPMG (2002) classified insurance company risks into three categories in terms of relative importance:

1. High importance – underwriting, asset liability matching, interest rate, credit risk, underwriting management and provisioning

2. Moderate importance – lapses, inflation rate, legal, liquidity, market price, reinsurer security, concentration risk and expenses

3. Low importance – environmental changes, social changes, economic cycle, reinsurance, technological changes and exchange rate

Shiu (2005) found that the factors most negatively correlated with an insurer's solvency were unexpected inflation, market competition, various product related reserves to total reserves, firm size and the total reserves to shareholders funds.

A study done by the regulators of 15 European Companies (McDonnell, 2002) concluded that management problems seemed to be the cause of every failure or near failure and that firms needed to understand the interaction of risks including both causal and unexpected links.

Many risks are not independent, but linked and often impact across lines of business and across assets and liabilities (KPMG, 2002). In studies of insolvencies, most insolvencies were not due to a single factor, but to a combination of internal and external events (Delloite., 2005).

3.6 Risk measurement

Risk measurement is the estimation of the probabilities of risks occurring and the cost impact of risk events (Ballou and Heitger, 2005). Estimates can be made using various approaches. There is no right or wrong answer and in the insurance industry, in particular, there are no standard measures or tools (Ernst & Young, 2004). In this section the different approaches to risk assessment and measurement are discussed. This includes both general risk measures and techniques such as models, sensitivity, stress and scenario testing as well as those more specific to particular risks.

3.6.1 General risk measures and techniques

When measuring risk, it is desirable to use measures that are easy to understand, can be tracked through time and that can be compared across portfolios/entities. Risk measurement is inherently an imprecise exercise. Data are not always available to calculate past returns accurately for all measures. (Kemp, 2005)

Models

Financial statements represent a retrospective view. The use of models helps management to assess the prospective financial situation and capital requirements. It expands the available information and improves decision making (KPMG, 2002). However, the use of models also introduces model risk – the risk that theoretical models used in pricing, hedging, trading and estimating risk will produce misleading results (Allen, 2003). It is also essential to understand the limitations of any model employed (LOMA, 2001).

Limitations and sources of model risk include:

- Difficulties can arise in ease of use, validation, communication, subjectivity and judgement, data, processes & systems and costs.
- The model may exclude a key source of risk. This is often not because risk is not identified, but because of trade-off between accuracy and complexity.
- Models are not usually linked to the company's accounting system.
- A proprietary model may not be well understood and therefore implemented incorrectly or with incorrect adjustments.
- In many cases data required to estimate reliable parameters are not available.
- Spreadsheet models can be prone to error and are difficult to validate.
- Due to the complexity of models, expertise is often focused in a small group of people. (Allen, 2003, KPMG, 2002)

KPMG (2002) identifies three types of risk models:

1. Static deterministic stress testing

   This type of model only considers the financial position of the company at a specific point in time. The advantage is that it allows simplistic investigation of an adverse development in a variety of risk variables. The disadvantages are that it only applies at the point in time tested and does not allow for the probability of the event happening.

2. Dynamic deterministic analysis

   In this kind of model, the calculation of the impact of the risk is extended by considering the development of the risk variable and exposure to it over time.

3. Dynamic probabilistic analysis

   This kind of model also allows for the probability of events happening. The advantages of this type of model are that the full range of risk variation is considered and the interaction between risks can be investigated.

The insurance industry has a long history of using financial models. The focus has, however, been on the estimation of expected values, rather than the deviation from the expected values. Models have also been developed for specific purposes and have not covered all the risks an insurer is exposed to. The most common types of models found within the insurance industry are deterministic models. Dynamic models with explicit cash flows are also common. Stochastic modelling is developing fast, but mainly remains the preserve of the larger companies. (KPMG, 2002)

Sensitivity analysis, Stress testing and scenario analysis

Sensitivity analysis is the expected change in the portfolio's value for a small change in one of the risk factors. Sensitivity analysis works well for small changes but breaks down when changes are large. (Marrison, 2002)

Stress testing is usually done for large changes in risk factors i.e. it addresses one of the weaknesses of sensitivity analysis (Marrison, 2002). In stress testing, the impact of exposure to an event is estimated. The probability of the event occurring is however not quantified (KPMG, 2002). Stress testing is used as there will always be events that are not anticipated in statistical modelling regardless of the sophistication of the model (LOMA, 2001).

The main drawbacks of stress testing are that it can generate large amounts of data without directly indicating the most significant problem and that the moves chosen to be tested are not related to a probability of movement. (Marrison, 2002)

Scenario testing is similar to stress testing, but changes in risk factors are tailored and subjectively chosen. Scenarios are typically derived from previous crises, the current portfolio - what event will be most damaging to us given this portfolio - and expert opinions. (Marrison, 2002)

Scenario testing is time consuming to do properly and only a limited number of scenarios can thus be tested. The values chosen to test are subjective and there is a potential conflict of interest as the expert in the risk is often the person who wants to take on the risk. (Marisson, 2002)

3.6.2 Specific insurance risk measures

The Capital Adequacy Requirement calculation required in terms of the Long term Insurance Act and PGN 104 requires the calculation of the effect of variation in the following specific risks on a deterministic basis: persistency, mortality and morbidity, annuitant mortality, expenses, equity market, property markets and interest rate (ASSA, 2005). All companies should therefore measure at least these risks.

In the survey done by the Institute and Faculty of Actuaries (Bartlett et al., 2005) it was established that all insurers measure the following risks even if only subjectively or on an ad-hoc basis: equity market, interest rate, property markets, credit spreads, reinsurance counterparty, portfolio liquidity, mortality and morbidity, longevity, persistency, expenses, tax, litigation, regulation, miss-selling and other operational risks.

Each of these risks can be measured subjectively, on an ad-hoc basis or using deterministic or stochastic models (Bartlett et al., 2005).

3.7 Risk responses and control activities

Other than setting the risk appetite, determining the responses are the most important decisions that need to be made in implementing a risk management framework. There are several responses that a company can take in response to a risk. In all cases, a company should be careful how a particular risk response affects other risks. (Ballou and Heitger, 2005)

3.7.1 Risk assumption

When risk is assumed, the consequences of a loss are borne by the party exposed to the loss. This response is often used where loss costs are small, but it is also appropriate in self-insurance programs either through funding or captive insurers. Sometimes, it is the default response because the risk was not identified. (Dorfman, 2002)

3.7.2 Risk modification

In risk modification, steps are taken to reduce the potential loss. This is the most common method of risk response (Jackson, 2006). Risk modification can be done through loss prevention and loss reduction.

The aim of loss prevention is to lower the frequency of losses. Loss prevention is used when the probability of a loss is high. However, it is only viable if the cost of preventing the loss is less than the potential loss. (Dorfman, 2002)

The aim of loss reduction is to reduce the severity of a loss. It is best used where a risk can not be avoided and the severity of the loss is high. Loss reduction can also only be justified if the cost is less than benefits. (Dorfman, 2002)

3.7.3 Risk avoidance

A company may avoid a risk by taking a different course of action (Holmes, 2004). When a risk is avoided, the chance of a loss has been eliminated. This is usually the best option when both the change of loss as well as severity of the loss is high. (Dorfman, 2002)

3.7.4 Risk transfer

When risk is transferred, another party is found to carry the risk, e.g. hedging and insurance. Under insurance the loss will be covered by a third party when it occurs (Holmes, 2004). When a risk is hedged, it is offset with another, leaving the company with no risk in total (Holmes, 2004). Insurance is best when the chance of loss is low, but the effect is high. (Dorfman, 2002)

The following figure provides a summary of the risk management tools and their appropriate uses.

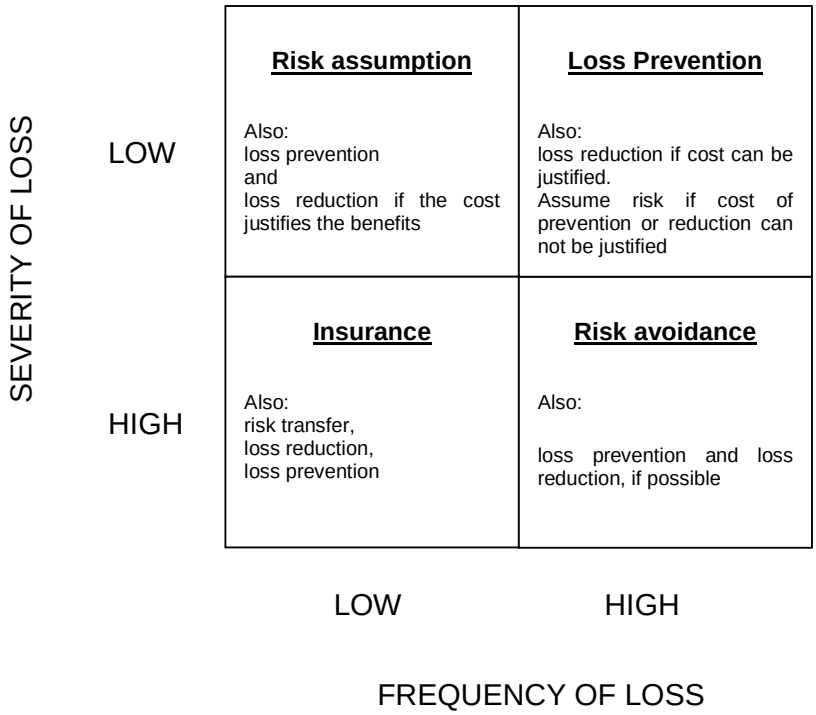

Figure 3 – Risk responses (Dorfman, 2002)

3.8 Internal reporting and monitoring

3.8.1 Information and Communication

There are many parties interested in the risk information. Internally, the risk management area, senior management and staff require reports to take appropriate action and to assist in decision making. Externally, the regulators need information to ensure that the company has a low probability of failure and investors want to check that adequate controls are in place and that risk is commensurate with their expected return. (Marrison, 2002) King (2002) requires that boards should receive and review reports on the risk management process at regular intervals.

Failures in risk management are often compounded by a lack of risk management information for senior management and boards. Companies are producing more risk information, but this is not always translating into useful information (Delloite., 2005). Information is expensive to produce, store and review. The emphasis should be on the efficient reporting of relevant i.e. actionable information. The information must also be consistent, timely and in the simplest form possible (LOMA, 2001). As a minimum, systems need to be able to track actual information and report actual events (Ballou and Heitger, 2005).

Ernst & Young (2005) states that a simple key risk summary report is probably the most important tool in a risk management framework. Such a report should describe the key risks, how they are being managed and monitored, key issues and who are accountable.

Tillinghast (2002b) provides the following guiding principles for risk reporting:

- Include both leading indicators and outcomes.
- Include actual, expected and benchmark for each measure.
- Include measures pertaining to all stakeholders.
- Limit the number of measures used to enable management focus.
- Organise the measures to clarify “line of sight”.
- Match frequency of reporting to the volatility and importance of the risk.

3.8.2 Monitoring

Monitoring is the final step in the risk management process. This is the audit, oversight and improvement of the risk management process. (Culp, 2002) Organisations are dynamic and operate in dynamic environments and the risk management process must be updated for changes in the environment (AIRMIC et al., 2002).

AIRMIC et al. (2002) specify the goals for the monitoring process as follows:

- Provide assurance that there are appropriate controls in place for the organisation’s activities and that the procedures are understood and followed.
- Review whether the measures adopted resulted in what was intended.
- Review whether the procedures adopted and the information gathered were appropriate.
- Identify lessons that could be learned for future assessment and management of risks.

3.9 Small insurers

Small insurers have problems that larger offices do not always share. Smaller companies have smaller portfolios and more volatile claims experience. They have less opportunity to diversify as they are usually niche insurers and also do not share the same access to resources as their larger counterparts.

In the Report of the Registrar of Long-term Insurance (Financial Services Board, 2007) the Registrar also expresses his concern over the lack of corporate governance, especially in smaller insurers. Other areas of concern mentioned are outsourcing arrangements and undue reliance on key individuals.

Implementing effective risk management processes takes significant resources and companies should thus focus on where the need is greatest (Ballou and Heitger, 2005). The risk management process should be appropriate for the size, nature and complexity of the company's business. However, from Basel we learnt that if smaller insurers are obliged to use standardised models for calculating their capital requirements, they may have to retain higher capital levels, giving the larger companies a competitive advantage. (KPMG, 2004)

4 RESEARCH HYPOTHESES

The hypotheses as derived from the literature review can be summarised as follows:

Hypothesis 1: The board is responsible for risk management.

Hypothesis 2: Companies have a variety of risk management structures including all combinations of formal, informal, centralised and decentralised.

Hypothesis 3: Companies have a risk policy in place, but have not yet defined their risk appetite/ risk tolerance.

Hypothesis 4: Companies are creating an effective risk management culture i.e. they are creating a risk management awareness and aligning the objectives of the key stakeholders.

Hypothesis 5*:* Companies have a regular risk identification process.

Hypothesis 6: Companies use a variety of methods to identify risks.

Hypothesis 7: Companies manage the variety of risks set out in Table 1: Risk Descriptions above.

Hypothesis 8: Different companies consider different risks important.

Hypothesis 9: Different insurers use different models to measure different risks.

Hypothesis 10: Different insurers have different responses to different risks.

Hypothesis 11: Information on different risks is monitored at different frequencies by the different life offices.

Hypothesis 12: Different insurers use different indicators to monitor the risks.

Hypothesis 13: The risks and risk management process followed in small insurers differ from those in larger insurers.

5 RESEARCH METHODOLOGY

The methodology followed to answer the research questions is described in this section. The research methodology, design, population and sample, data collection, data analysis and the validity and reliability are described in that order.

5.1 Research methodology

The research was conducted through questionnaires. The data arising from the questionnaires were quantitative.

5.2 Research Design

The study was in the form of a survey through questionnaires (Leedy and Ormrod, 2001).

An advantage of questionnaires is that people can respond to questionnaires with the assurance that their responses will be anonymous. However, a drawback is that the majority of people who receive questionnaires do not return them. (Leedy and Ormrod, 2001) To try and improve the response rate, the questionnaire should be kept as short as possible and the respondent's task made as simple as possible (Leedy and Ormrod, 2001). This implies finding the balance such that the questionnaire is not too long, but also does not exclude important questions.

A questionnaire was prepared using the information gained during the literature review. The aim was to have a questionnaire that would take 20-30 minutes to complete if done by the person with the appropriate knowledge in the company. This still allowed for enough information to be gathered.

5.3 Population and sample

5.3.1 Population

The population consisted of all the life insurers registered with the Financial Services Board to sell life assurance in South Africa. Where a group owns more

than one life insurer, the group was included as a single insurer. Insurance companies taken over by other insurers also fall in this category and were therefore excluded. The population thus consisted of 61 insurance companies and groups.

5.3.2 Sample

Due to the size of the population a sample was not be taken. Questionnaires were sent to all the companies or groups in the population. A list of the registered insurers and reinsurers is attached as Appendix 1 (Financial Services Board, 2007).

5.4 Data collection

The questionnaire was e-mailed to the Principal Officer of each company. The covering e-mail and the questionnaire are attached as Appendix 2 and Appendix 3 respectively. Following the first round of responses, follow-up calls were made to selected companies to increase the number of responses received.

5.5 Data analysis and interpretation

The responses to the questionnaires were captured and analysed in Excel and SPSS statistical software.

Nonparametric statistics were used for the statistical tests. Non-parametric statistics depend on a minimum of assumptions and can be used when the data are measured on a weak scale (Daniel, 1990).

In all the statistical tests, the level of significance was set at 5%. This implies a 5% probability that a true null hypothesis could be rejected (Cooper and Schindler, 1998).

SPSS provides the test statistic and the significance level. The significance level is the probability of getting the test statistic value as calculated, assuming that the null hypothesis is true (Dancey and Reidy, 2002). A calculated significance level greater than 5% (the selected significance level) therefore means that the null hypothesis can not be rejected.

5.5.1 Response bias

The size of the company was measured using an ordinal scale. The Kolmogorov-Smirnov two sample test was used to check whether the responses and the non-responses come from populations that are identical in terms of location and dispersion (Daniel, 1990).

5.5.2 The Internal Risk Environment

Summary data were prepared and inspected for each of the questions.

The X^2 goodness of fit test was used to test whether the proportion reporting a formal structure differed significantly from those reporting an informal structure (Cooper and Schindler, 1998). The same test was done for the responses on a centralised approach.

The Fischer exact test was used to test if a relationship between the type of structure and the approach exists (Cooper and Schindler, 1998).

The X^2 goodness of fit test was used to test whether the proportion reporting that they have a risk policy in place differed significantly from those reporting that they don't (Cooper and Schindler, 1998). The same test was done for the responses on defining their risk appetite.

The Fischer exact test was used to test if a relationship between having a risk policy and defining their risk appetite exists (Cooper and Schindler, 1998).

5.5.3 Risk assessment

Summary data were prepared and inspected for each of the questions.

5.5.4 Insurance company risks

Answers to the questions indicating the importance of the risk were converted to values. A value was assigned to each possible response starting with 1 for “very important” to 4 for “do not monitor”. The mean, mode and median were calculated to establish which risks the companies considered most important. As none of these measures provide the complete picture, the variance was also calculated and risks where the variances in the responses were high were inspected to identify possible reasons for this. Summary tables were also prepared and inspected.

5.5.5 Risk measurement

Summary data were prepared and inspected for each of the risks.

The data for all the risks were combined to investigate whether there was any relationship between how important the insurer thought the risk was and how the risk was measured. The data for importance were measured on an ordinal scale, but the data for the type of measure were on a nominal scale. There is no fully satisfactory all purpose measure to use for categorical data (Cooper and Schindler, 1998). Cramer’s V, a X^2-based measure and λ a proportional reduction in error measure were both calculated (Cooper and Schindler, 1998).

5.5.6 Risk responses

The questionnaire was not clear on only ticking one box. Several companies indicated more than one response to a risk, whilst others indicated only one. The responses for loss prevention and loss reduction were combined into a single category named risk modification.

Summary data were prepared and inspected for each of the risks.

5.5.7 Monitoring

Summary data were prepared and inspected for each of the risks.

The data for all the risks were combined to investigate whether there was any relationship between how important the insurer thought the risk was and how frequently the risk was monitored. The data for both variables were measured on an ordinal scale and Spearman's rank correlation coefficient was used (Daniel, 1990).

5.5.8 Differences between small and large insurance companies

In most of the cases, the appropriate statistical test to use for the comparison by size would be the X^2 Two-samples test (Cooper and Schindler, 1998).

The X^2-test uses expected frequencies in the calculation of the test statistic. The test should not be used if more than 20% of the expected frequencies are smaller than five or when any expected frequency is less than one when the degrees of freedom is greater than one (Cooper and Schindler, 1998). The test can usually be used if the degrees of freedom is less than 30 and the minimum expected frequency is two or more (Daniel, 1990).

Due to the small sample size, often neither of the above conditions applied when using three categories for size in the testing for significant effects. The companies were therefore reclassified into small and large only, by using the average of their ranking using policyholder liabilities and shareholder funds.

By reducing the number of categories, the Fisher exact test could also be used for certain tests. The Fisher exact test is not sensitive to small expected frequencies (Dancey and Reidy, 2002).

The Internal Risk Environment

The Fisher exact test was used to test for differences by size in the approach to risk management i.e. formal or informal, the approach to centralisation, whether a formal risk policy has been established and whether the risk appetite has been defined.

The Fisher exact test was also used to test for difference by size in the approaches to informing staff of the risk management policy.

The data were not adequate for the requirements for the X^2 two-sample test and a test for differences in the use of incentives could not be done.

Risk assessment

The data on how often the risk assessment exercise is run were measured on an ordinal scale. The Kolmogorov-Smirnov two samples test was used to test for differences in the frequency of reporting by size.

The data on the tools used during risk assessment were measured on a nominal scale. The Fisher exact test was used to test for the difference in usage of the tools by size of company for each of the tools independently.

Insurance company risks

The data for the importance of the risks were measured on an ordinal scale. The Kolmogorov-Smirnov two-sample test was used to test for any differences by size of company. The test was run for each risk and the significance levels obtained were compared with the set significance level.

Risk measurement

The data on the methods used for risk measurement were measured on a nominal scale. The data were not adequate for the requirements for the X^2 two-samples test and a test for differences in the use of incentives could not be done.

Risk responses

The data for the risk responses were measured on a nominal scale. The data were not adequate for the requirements for the X^2 two-samples test and a test for differences in the use of incentives could not be done.

Monitoring

The data on the frequency of the monitoring of the risks were measured on an ordinal scale. The Kolmogorov-Smirnov two-sample test was used to test for any differences by size of company. The test was run for each risk and the significance levels obtained were compared with the set significance level.

The data on the types of measures used in monitoring the risks were measured on a nominal scale. The data were not adequate for the requirements for the X^2 two-samples test and a test for differences in the use of incentives could not be done.

5.6 Validity and reliability

According to Leedy & Ormrod (2001) two questions need to be addressed when considering validity:

1. Does study have sufficient controls to ensure that the conclusions drawn are warranted by the data? This is the internal validity.

2. Can the results observed in the study be used to make generalisations about the world beyond the research situation? This is the external validity.

5.6.1 External validity

External validity refers to the extent to which the results can be generalised to situations beyond the study itself (Leedy and Ormrod, 2001). The responses were checked to see if they were representative of the population.

5.6.2 Internal validity

To ensure internal validity, all precautions must be taken to eliminate other possible explanations for the results observed (Leedy and Ormrod, 2001). The study was a survey and did not try to establish cause.

5.6.3 Reliability

Reliability has to do with the degree to which a measurement instrument produces consistent results (Leedy and Ormrod, 2001). The same standard questionnaire, asking only for factual information, was given to all participants to complete.

6 RESULTS

6.1 Response rate and validity

The questionnaire was sent to the population of 61 life insurers. Nineteen companies responded, giving a response rate of 31%. Unfortunately, two of these companies indicated that they are only in the process of starting up their company. This left a total of 17 responses for analysis.

The following graph shows the composition of the companies which responded compared to the total population.

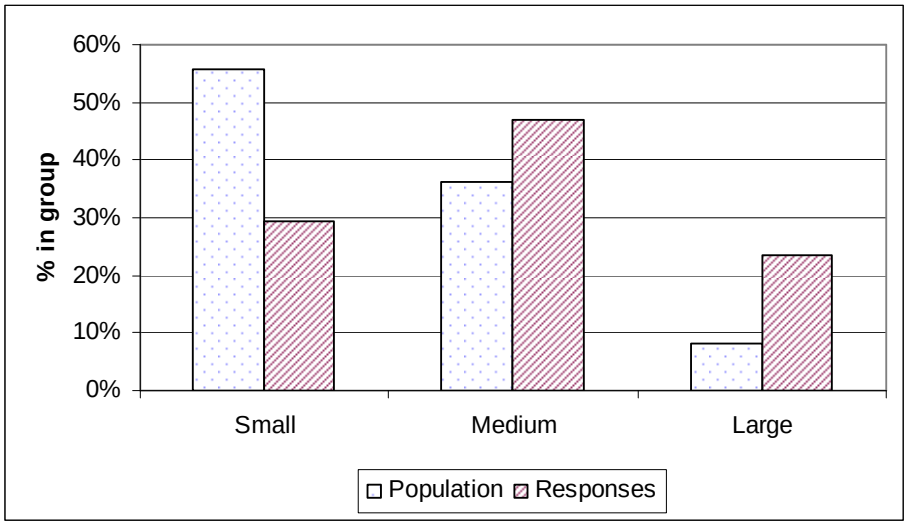

Figure 4 – Composition of responses compared to population

The significance level from the Kolmogorov-Smirnov test done to test for difference in the groups of responses and non-responses is 0,076. The SPSS printout is attached as Appendix 4. The null hypothesis that the two groups come from populations that are identical in terms of location and dispersion can therefore not be rejected.

While the difference is not statistically significant, it should be kept in mind, there may still be a non-response bias, as the companies that did not respond may feel that their processes are not up to standard and they therefore declined to participate.

6.2 The Internal Risk Environment

All respondents indicated that the responsibility for risk management rests with the board. Many also mentioned other forums such as Line Management, the Audit Committee and the Risk Committee or Risk Forum.

Hypothesis 1: The board is responsible for risk management can therefore be considered true.

A formal risk management structure is the most common with 70% of the companies reporting that they have one. The significance level from the X^2 test for differences in the proportions reporting formal and informal structures was 0.09. The difference is therefore not significant. The SPSS printout is attached as Appendix 5. The following table sets out the number of companies with formal and informal structures.

Table 2: Risk management structure

	Formal	Informal
Small	4	2
Medium	3	3
Large	5	0
Total	12	5

When considering the risk management approach of the companies, the split between companies using a centralised approach compared to a decentralised approach is almost equal. The significance level from the X^2 test for differences in the proportions reporting centralised and decentralised structures was 0.467. The difference is therefore not significant. The SPSS printout is attached as Appendix 5. The following table sets out the number of companies with centralised and decentralised approaches.

Table 3: Risk management approach

	Centralised	Decentralized
Small	6	
Medium	1	5
Large	3	2
Total	10	7

Companies with a formal structure also seem to follow a centralised approach. However, the significance level given by the Fischer exact test when testing for a relationship between the two variables was 0.593. The SPSS printout is attached as Appendix 5. The relationship is therefore not significant. The following table summarises the responses on structure and centralisation

Table 4: Risk management structure and centralisation

	Formal	Informal
Centralised	8	2
Decentralised	4	3
Grand Total	12	5

Hypothesis 2 that companies have a large variety of risk management structures can therefore be considered true.

All the companies, except three indicated that they have a formal risk management policy or strategy. The significance level from the X^2 test for differences in the proportions reporting that they have a formal policy those who don't was 0.008. The difference is therefore significant. The SPSS printout is attached as Appendix 5. The following tables set out the number of companies with defined risk strategies.

Table 5: Risk management policy

	Formal policy	No formal policy
Small	4	2
Medium	5	1
Large	5	
Total	14	3

All the companies, except four indicated that they have defined their risk appetite, though some did admit that it could do with further work. The significance level from the X^2 test for differences in the proportions reporting that they have a formal policy those who don't was 0.029. The difference is therefore not significant even though it is marginal. The SPSS printout is attached as Appendix 5. The following tables set out the number of companies with defined risk appetite.

Table 6: Risk appetite

	Defined	Not defined
Small	4	2
Medium	5	1
Large	4	1
Total	13	4

Companies with a formal policy have also defined their risk appetite. The significance level given by the Fisher exact test when testing for this relationship is 0.006. The SPSS printout is attached as Appendix 5. The following table summarises the responses on risk management policy and risk appetite.

Table 7: Risk management policy and appetite

	Defined	Not defined
Formal policy	13	1
No formal policy		3
Total	13	4

Hypothesis 3 that companies have a risk policy in place, but have not yet defined their risk appetite is not true. Companies have a risk policy in place and have defined their risk appetite.

Where a company has a risk strategy, staff are generally informed about the strategy in meetings and discussions as well as through written instructions and procedures. The following table summarises the methods of informing staff.

Table 8: Methods of informing staff

	Verbal	Written	Induction
Small	3	4	0
Medium	4	2	1
Large	5	3	2
Total	12	9	3

Five companies indicated that risk management objectives are included in their company incentive schemes. However, they all qualified the question by mentioning that it was only for certain staff. Two further companies indicated that they were considering it.

Table 9: Incentives

	Included	Considering	Not included
Small	2	1	3
Medium	2		4
Large	1	1	3
Total	5	2	10

Based on the results, it is difficult to come to a conclusion on Hypothesis 4 that companies are creating a risk management awareness and aligning the objectives of the stakeholders.

6.3 Risk assessment

Two companies indicated that they have never formally completed a risk identification process. One company runs its process every two years and four annually. The remaining companies update their risks more often than annually, with three of the large insurers indicating that they update their risks on a monthly basis.

Table 10: Timing of risk identification

	Never	≥ annual	Annually	6 months	quarterly	Monthly
Small	1	1	3			1
Medium	1			2	3	
Large			1		1	3
Total	2	1	4	2	4	4

Hypothesis 5 that companies have a regular risk identification process can therefore be considered true.

Almost all companies use workshops in their risk identification process. Just more than half also use external assistance. Surveys and external benchmarks are not commonly used. Other methods that were used in the risk identification process were Internal Audit's investigations, other ad-hoc investigations, input from the Risk and Compliance departments, interviews and using data from external losses incurred. The following table summarises the assessment tools used.

Table 11: Assessment tools

	Surveys	Workshops	External assistance	External benchmarks
Small	1	5	3	2
Medium	1	4	4	1
Large	2	5	2	1
Total	4	14	9	4

Hypothesis 6 that companies use a variety of methods to identify risks can therefore be considered true.

6.4 Insurance Company Risks

With the exception of the insurers who were not exposed to certain risks due to the niche in which they operated (e.g. an insurer covering only mortality with its assets in conservative investments or an investment insurer not exposed to mortality) all the insurers indicated that they considered the majority of the risks at least moderately important.

Hypothesis 7 that companies manage the risks set out in Table 1: Risk Descriptions can be considered true.

When one considers the mode (the value that occurs the most) to establish which risks are most important, all risks with the exception of reinsurance, group, credit, catastrophe, outsourcing, economic and social changes are considered very important. When looking at the mean and variance, the risks that are consistently rated very important by all insurers are the risk of technical reserves and pricing being inadequate.

The risks where the responses varied the most were group risk, market changes, market risk, catastrophe risk, liquidity (trading) and the risk of social & political changes. This difference was mainly due to the fact that the niche insurers do not monitor these risks.

The only other risk mentioned was Compliance/Regulatory risk, which was considered very important by one of the large insurers.

The following figure shows the relative importance of the risks as considered by the insurers. The lines show the range of responses given, while the square indicates the average using the values assigned to each response. A low number indicates that a risk is more important than a high number.

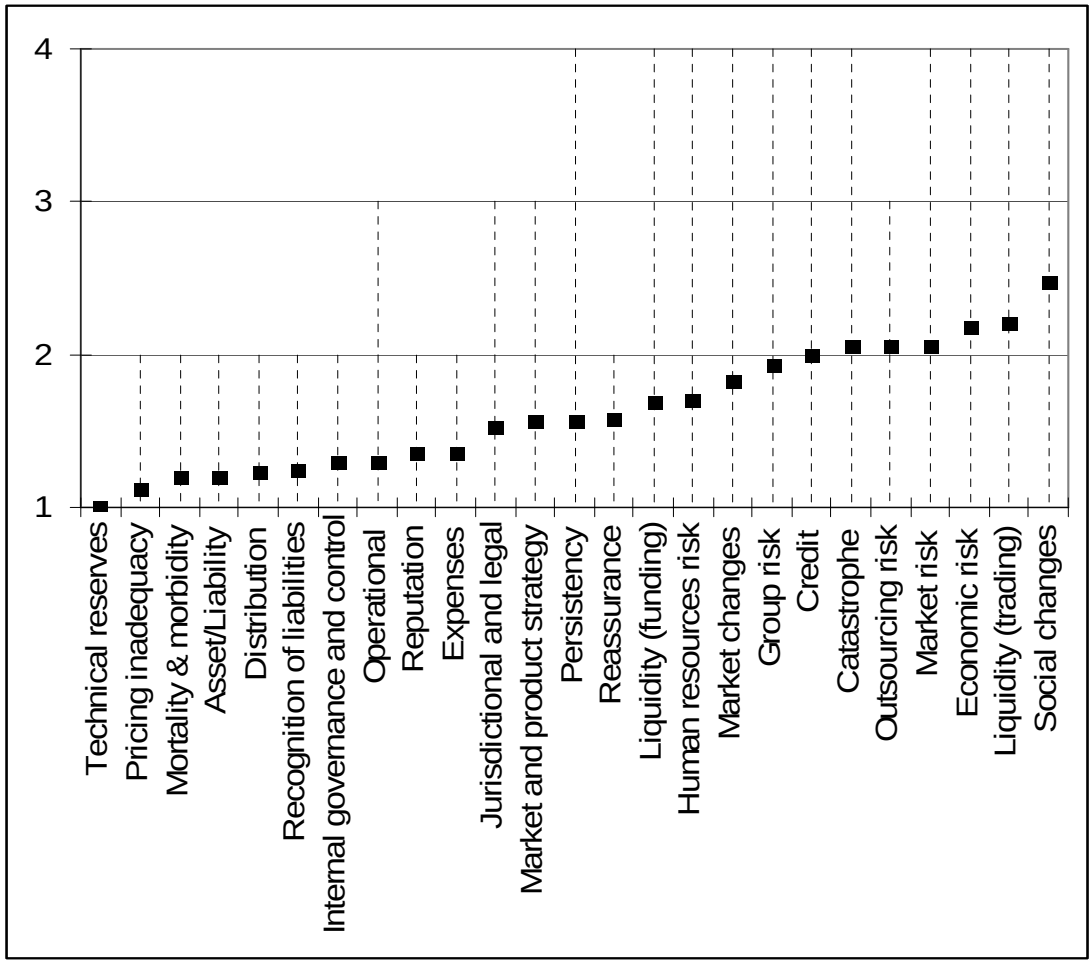

Figure 5 – Importance of Risks

Hypothesis 8 that different companies consider different risks to be the most important is not true. All the companies consider the same risks to be important.

6.5 Risk Measurement

The insurers use a wide variety of methods to measure the risks. These include subjective assessments, ad hoc calculations, deterministic models and stochastic models.

The following table contains the summary data for the ways in which the insurers measure their risks. The mode, which is the option that occurs most often, is also given.

Table 12: Summary of measurement methods

Risk	Do Not	Ad Hoc	Sub-jective	Deter-ministic	Sto-chastic	Mode
Market and product strategy	0	1	13	1	0	Subjective
Distribution	0	1	8	4	0	Subjective
Reputation	2	0	14	0	0	Subjective
Pricing inadequacy	0	1	1	9	4	Deterministic
Persistency	0	0	2	11	2	Deterministic
Mortality & morbidity	0	0	1	7	6	Deterministic
Expenses	0	4	2	10	0	Deterministic
Credit	2	2	7	2	1	Subjective
Liquidity (trading)	3	4	3	2	2	Ad Hoc
Liquidity (funding)	1	5	3	5	1	Ad Hoc
Operational	0	2	13	0	0	Subjective
Outsourcing risk	3	1	10	0	0	Subjective
Human resources risk	4	1	11	0	0	Subjective
Internal governance and control risk	2	2	12	0	0	Subjective
Group risk	2	2	9	0	1	Subjective
Reinsurance	1	2	1	6	2	Deterministic
Asset/Liability Management	0	1	2	8	3	Deterministic
Technical reserves	0	0	1	11	3	Deterministic
Recognition of liabilities	0	0	3	9	3	Deterministic
Jurisdictional and legal	3	2	11	0	0	Subjective
Market changes	2	2	8	2	2	Subjective
Catastrophe	4	1	5	4	2	Subjective
Market risk	2	2	5	3	3	Subjective
Economic risk	3	1	7	3	2	Subjective
Social and other changes	4	2	10	0	0	Subjective

There is a relationship between the importance of the risk and the way in which it is measured. Both the Cramer's V and λ measures calculated show a significant correlation at the 5% level. The SPSS printout is attached as Appendix 6.

The risk of technical reserves and pricing being inadequate as well as mortality/morbidity risk were considered the most important risks. This is reflected by the way in which these risks are measured. All companies use at least a deterministic model, with several companies using stochastic models to measure these risks.

Risks for which deterministic models are used as the main measurement tool are:

Table 13: Risks measured with deterministic models

Persistency	Reinsurance
Expenses	Asset/liability management
Funding liquidity	

It is not surprising, due to the difficulty in quantifying them, that the following risks are measured using subjective assessment by almost all the insurers.

Table 14: Risks measured subjectively

Market and product strategy	Human resources risk
Reputation	Internal governance and control risk
Operational	Jurisdictional and legal
Outsourcing risk	Social and other changes

The approach to the remaining risks varies significantly, from the smaller insurers not measuring it at all to usually the larger insurers measuring it stochastically.

Hypothesis 9 that different companies use different models to measure the different risks can be considered true.

6.6 Risk Responses and Control Activities

Insurers have different responses to the different risks and put different control activities in place. The following table contains the summary data for the ways in which the insurers respond to the risks. The mode, which is the option that occurs most often, is also given. Risk modification includes both the reduction of the size of loss and the reduction in the probability of loss.

Table 15: Risk responses

	Assume	Modify	Transfer	Avoid	Mode
Market and product strategy	9	5	0	0	Assume
Distribution	5	7	0	0	Modify
Reputation	9	6	0	0	Assume
Pricing inadequacy	2	10	2	1	Modify
Persistency	3	10	0	1	Modify
Mortality & morbidity	3	8	2	0	Modify
Expenses	5	9	0	1	Modify
Credit	1	10	1	1	Modify
Liquidity (trading)	7	5	0	1	Assume
Liquidity (funding)	5	5	0	4	
Operational	6	9	0	0	Modify
Outsourcing risk	5	5	1	2	
Human resources risk	7	8	0	0	Modify
Internal governance and control risk	5	10	0	0	Modify
Group risk	8	4	0	1	Assume
Reinsurance	1	6	3	0	Modify
Asset/Liability Management	2	10	0	1	Modify
Technical reserves	2	11	0	1	Modify
Recognition of liabilities	3	11	0	0	Modify
Jurisdictional and legal	9	6	0	0	Assume
Market changes	7	8	0	0	Modify
Catastrophe	6	5	4	0	Assume
Market risk	7	6	1	0	Assume
Economic risk	9	5	1	0	Assume
Social and other changes	8	6	0	0	Assume

Risk avoidance was a rare response. This is probably due to the nature of the insurance company risks presented and the difficulty in avoiding them in providing insurance.

Hypothesis 10 that insurers have different responses to the different risks can be considered true.

6.7 Internal Reporting and Monitoring

The regularity with which the different risks are measured differs. The following table contains the summary data for how often the insurers measure and report on the different risks. The mode, which is the option that occurs most often, is also given.

Table 16: Monitoring and reporting frequency

Risk	Week	Month	Quarter	Annual	Other	Mode
Market and product strategy	0	4	6	0	5	Quarterly
Distribution	2	5	2	0	4	Monthly
Reputation	1	3	2	0	9	Other
Pricing inadequacy	0	4	6	5	1	Quarterly
Persistency	1	5	5	4	0	Monthly
Mortality & morbidity	0	3	6	4	1	Quarterly
Expenses	1	8	5	1	1	Monthly
Credit	1	5	1	0	7	Other
Liquidity (trading)	0	5	4	0	5	Monthly
Liquidity (funding)	0	5	5	0	5	Quarterly
Operational	3	5	1	1	6	Other
Outsourcing risk	2	1	2	0	8	Other
Human resources risk	1	4	4	1	6	Other
Internal governance and control risk	5	0	7	0	4	Quarterly
Group risk	1	1	3	2	6	Other
Reinsurance	1	3	1	5	1	Annually
Asset/Liability Management	1	4	5	3	1	Quarterly
Technical reserves	0	6	7	1	1	Quarterly
Recognition of liabilities	0	3	8	1	3	Quarterly
Jurisdictional and legal	2	3	3	0	8	Other
Market changes	1	4	4	1	6	Other
Catastrophe	1	1	3	8	3	Annually
Market risk	1	3	7	1	3	Quarterly
Economic risk	0	3	7	2	4	Quarterly
Social and other changes	1	1	2	3	8	Other

There is a relationship between the importance attached to a risk and the frequency companies monitor it. Inspecting the data shows that the more important risks are monitored more frequently. The Spearman's rank correlation-coefficient calculated was 0.242 and the significance level was 0.000. This is significant at a 5% level. The SPSS printout is attached as Appendix 6.

Companies monitor the actual experience for all risks. The following table summarises the measures monitored for each risk. For every risk, the measure most often monitored was the actual experience.

Table 17: Measures monitored

Risk	Actual	Leading indicators	Supervisory reports	Other
Market and product strategy	10	3	0	1
Distribution	10	1	1	0
Reputation	10	1	1	4
Pricing inadequacy	16	0	0	0
Persistency	15	0	0	0
Mortality & morbidity	14	1	0	0
Expenses	16	0	0	0
Credit	11	2	0	1
Liquidity (trading)	12	1	1	0
Liquidity (funding)	11	1	3	0
Operational	14	1	1	0
Outsourcing risk	8	0	1	3
Human resources risk	9	3	4	0
Internal governance and control	10	1	5	0
Group risk	8	1	1	3
Reinsurance	11	0	0	0
Asset/Liability	12	1	1	0
Technical reserves	14	0	1	0
Recognition of liabilities	13	1	1	0
Jurisdictional and legal	9	1	4	2
Market changes	8	4	2	2
Catastrophe	9	2	2	2
Market risk	8	4	1	2
Economic risk	8	5	1	2
Social and other changes	8	3	1	3

6.8 Differences between small and large insurers

6.8.1 Internal Risk Environment

There is no significant difference in the internal risk environment of the small and large insurers. The lowest significance level for the Fisher exact test when testing for differences by size was 0.082 for a formal risk policy. The SPSS printout is attached as Appendix 7.

There is a difference in the way that small and large companies communicate their risk management objectives. The small companies do not use verbal communication for the communication of their risk objectives. Whilst the data shows this, it does seem counter intuitive. The significance level for the Fischer exact tests when testing for differences in size are summarised in the following table. The SPSS printout is attached as Appendix 7.

Table 18: Communication differences by size

Verbal	0.029
Written	0.581
Induction	0.124

A test could not be completed for the difference in incentives, but from an inspection of the summary data, there does not seem to be a difference.

6.8.2 Risk assessment

The significance value given by the Kolmogorov-Smirnov two-sample test when testing for differences in the frequency of assessment was 0.063. There is therefore no significant difference in the frequency, though this is marginal. The SPSS printout is attached as Appendix 8.

The significance levels given by the Fisher exact test when testing for differences by size for the tools used were greater than 0.5 for all the tests indicating that there is no difference. The SPSS printout is attached as Appendix 8.

6.8.3 Insurance company risks

There were no significant differences in the importance of the risks to the companies by size. The lowest significant value was for jurisdictional and legal risk and this was 0.189. The SPSS printouts are attached as Appendix 9.

6.8.4 Monitoring

There were no significant differences in the frequency of monitoring the risks by size. The lowest significant value was for technical reserves and this was 0.231. The SPSS printouts are attached as Appendix 10.

7 CONCLUSIONS

The purpose of the research was to establish the risk management practices of life insurers in South Africa and to compare the practices of small and large companies.

In all companies it is recognised that the responsibility for risk management rests with the board. The majority of insurance companies are following a formal approach to risk management. However, the split between a centralised and decentralised approach is almost equal. Almost all the companies have a formal risk management policy or strategy in place and they have defined their risk appetite. Risk management objectives are communicated verbally and in writing, but are not usually included in the companies' incentive schemes.

Most companies complete a risk identification process annually or more often. The risks that are consistently rated very important by all insurers are the risk of technical reserves and pricing being inadequate.

Risks which can be quantified are measured by models. Deterministic models are the most common, but some companies use stochastic models for the more important risks. Risks that are difficult to quantify are measured subjectively by all insurers.

Modification of the risk – reducing the probability of a loss occurring or the size if the loss when it occurs or a combination of both – was the most common response to the important risks. For the less important risks, risk assumption was the most common response. Risk avoidance as a response was rare.

Companies monitor the different risks at different time intervals, but the more important risks are monitored more often. Companies monitor the actual experience for all risks.

Surprisingly, there were no significant differences in the responses by the smaller and larger companies. This could be due to the fact that only the smaller companies with an established risk management process responded. In addition,

the small sample size, due to the small population, and the resulting conservative statistical tests that were used, could mean that some possible differences are not shown as statistically significant.

8 AREAS FOR FURTHER RESEARCH

This was an introductory study focussing on the basic practices of the life offices and comparing the approaches taken by small and large companies, without getting into the detail of the calculations and exact measurements.

A study sanctioned by the regulator, forcing companies to participate, may also provide a better response and a better understanding of what all the smaller companies are doing.

Further research can be done to investigate the detail i.e. which exact measures do insurance companies use for which risks and how are they calculated?

A study could be done on the use of risk based capital within insurers.

The relationship between risk management and capital management could be explored.

Lastly, a study on the external reporting i.e. to the shareholders of the companies can be done.

REFERENCES

AIRMIC, ALARM & IRM (2002) A Risk Management Standard. The Institute of Risk Management (IRM), The Association of Insurance and Risk Managers (AIRMIC) & ALARM The National Forum for Risk Management in the Public Sector.

ALLEN, S. (2003) *Financial Risk Management: A Practitioner's Guide to Managing Market and Credit Risk,* Hoboken, John Wiley & Sons.

ASSA (2005) PGN 104: Life Offices – Valuation of Long-Term Insurers. www.assa.org.za.

BALLOU, B. & HEITGER, D. L. (2005) A Building-Block Approach for Implementing COSO's Enterprise Risk Management Framework. *Management Accounting Quarterly,* 6**,** 1-10.

BARFIELD, R. (2005) Risk Appetite - How Hungry Are You? *PricewaterhouseCoopers - The Journal.*

BARTLETT, D., CHAPLIN, M., DOWD, K., KELLIHER, P. & O BRIEN, C. (2005) Risk Management by UK Life Assurers: A Survey. Faculty and Institute of Actuaries.

BASEL COMMITTEE ON BANKING SUPERVISION (2005) International Convergence of Capital Measurement and Capital Standards: A Revised Framework. Basel, Bank for International Settlements.

BENFIELD, B. C. (2004) *Life Insurance Company Management,* Bryanston, Primary Asset Administrative Services.

BRIDGE-DAVID, S. (2005) Ngalwana Turning Life Insurance Industry on its Head. *Business Report.*

BRITT, S., DARDIS, A., GILKISON, M., MORIN, F. & WILSON, M. M. (2002) Risk Position Reporting. Society of Actuaries.

COOPER, D. R. & SCHINDLER, P. S. (1998) *Business Research Methods,* Singapore, Irwin McGraw-Hill.

COSO (2004) Enterprise Risk Management - Integrated Framework: Executive Summary. Committee of the Sponsoring Organisations of the Treadway Commission.

CULP, C. L. (2002) *The ART of Risk Management: Alternative Risk Transfer, Capital Structure, and the Convergence of Insurance and Capital Markets,* New York, John Wiley & Sons.

DANCEY, C. P. & REIDY, J. (2002) *Statistics Without Maths for Psychology,* Essex, Pearson Education Limited.

DANIEL, W. W. (1990) *Applied Nonparametric Statistics,* Boston, PWS-KENT Publishing Company.

DARDIS, A. (2002) Risk Position Reporting in the South African Life-Insurance Industry. *South African Actuarial Journal,* 2**,** 1-28.

DELLOITE. (2005) Disarming the Value Killers: A Risk Management Survey. Delloite.

DORFMAN, M. S. (2002) *Introduction to Risk Management and Insurance,* Upper Saddle River, Prentice Hall.

ERNST & YOUNG (2004) A Brave New World: Risk Measurement and Capital Management in the Insurance Industry. Ernst & Young.

ERNST & YOUNG (2005) Managing Risk Across the Enterprise: Connecting New Challenges with Opportunities. Ernst & Young.

ERNST & YOUNG (2006) Companies on Risk: The Benefits of Alignment. Ernst & Young.

FINANCIAL SERVICES BOARD (2007) Eighth Annual Report of the Registrar of Long-term Insurance. Financial Services Board.

FSA (2003) The Firm Risk Assessment Framework. Financial Services Authority.

HOLMES, A. (2004) *Smart Risk,* West Sussex, Capstone Publishing Limited.

JACKSON, P. M. (2006) *Non-profit Risk Management & Contingency Planning,* Hoboken, John Wiley & Sons.

KEMP, M. H. D. (2005) Risk Management in a Fair Valuation World. *British Actuarial Journal.*

KENDRICK, T. (2004) Strategic Risk: Am I doing ok? *Corporate Governance,* 4**,** 69-77.

KING COMMITTEE (2002) King Report on Corporate Governance for South Africa 2002. Parktown, Institute of Directors in Southern Africa.

KPMG (2002) Study Into the Methodologies to Assess the Overall Financial Position of an Insurance Undertaking from the Perspective of Prudential Supervision. Brussels, European Commission.

KPMG (2004) Risk and Capital Management for Insurers: Survey of Capital Assessment Practice in the Insurance Sector. KPMG International.

LEEDY, P. D. & ORMROD, J. E. (2001) *Practical Research: Planning and Design,* Upper Saddle River, Merrill Prentice Hall.

LOMA (2001) Enterprise Risk Management in the Life Insurance Industry. Life Office Management Association (LOMA).

LONDON WORKING GROUP (2002) Prudential Supervision of Insurance Undertakings. Conference of the Insurance Supervisory Services of the Member States of the European Union.

MARRISON, C. (2002) *The Fundamentals of Risk Measurement,* New York, McGraw-Hill.

MCDONNELL, W. (2002) Managing Risk: Practical Lessons from Recent "Failures" of EU Insurers. Financial Services Authority.

NATIONAL TREASURY (2006) Contractual Savings in the Life Insurance Industry: Discussion Paper. National Treasury South Africa.

NOY, E. & ELLIS, S. (2003) Risk: A neglected Component of Strategy Formulation. *Journal of Managerial Psychology,* 18**,** 691-707.

PWC (2004) Enterprise-wide Risk Management for the Insurance Industry. PricewaterhouseCoopers.

RUSCONI, R. D. (2005) Saving for Retirement in South Africa: Charges to the Consumer. *South African Actuarial Journal,* 5**,** 61-133.

SHIU, Y. (2005) The Determinants of Solvency in the United Kingdom Life Insurance Market. *Applied Economics Letters,* 12**,** 339-344.

SMALLMAN, C. (1996) Risk and Organisational Behaviour: A Research Model. *Disaster Prevention and Management,* 5**,** 12-26.

SOA RISK MANAGEMENT COMMITTEE (2005) Report of the Society of Actuaries Risk Management Survey Subcommittee. Society of Actuaries.

TILLINGHAST (2002a) Enterprise Risk Management in the Insurance Industry: 2002 Benchmarking Survey Report. Tillinghast.

TILLINGHAST (2002b) RiskValueInsights^{TM}: Creating Value Through Enterprise Risk Management - A Practical Approach for the Insurance Industry. Tillinghast.

TILLINGHAST (2004) Adding Value Through Risk and Capital Management: An ERM Update on the Global Insurance Industry Tillinghast.

TILLINGHAST (2006) Life Insurance CFO Survey #13: Enterprise Risk Management. Tillinghast.

VON BOMHARD, N. (2005) Risk and Capital Management in Insurance Companies. *The Geneva Papers,* 30**,** 52-59.

APPENDIX 1 – REGISTERED INSURERS AND REINSURERS

Insurers

1 Direct Life Insurance Limited

ABSA Life Limited

African Life Assurance Company Limited

AIG Life South Africa Limited

Alexander Forbes Life Limited

Algoa Insurance Company Limited

Allan Gray Life Limited

Alternative Channel Life Limited

Anglo Dutch Life Limited

Assupol Life

AVBOB Mutual Assurance Society

Barinor Insurance Limited

BOE Life Limited

Channel Life Limited

Citadel Life Limited

Clientele Life Assurance Company Limited

Constantia Life & Health Assurance Company Limited

Coronation Life Assurance Company Limited

Corpcapital Life Insurance Limited

Discovery Life Limited

Goodall And Bourne Assurance (Pty) Limited

Goodall And Company Funeral Assurance Society (Pty) Ltd

Guardrisk Life Limited

Hollard Life Assurance Company Limited

HTG Life Limited

Investec Assurance Limited

Investec Employee Benefits Limited

Investment Solutions Limited

KGA Lewens Beperk

Liberty Active Limited
Liberty Group Limited
Lion Of Africa Life Assurance Company Limited
M Cubed Life Limited
Mclife Assurance Company Limited
Medscheme Life Assurance Company Limited
Metropolitan Life International Limited
Metropolitan Life Limited
Metropolitan Odyssey Limited
Momentum Ability Limited
Momentum Group Limited
Nedgroup Life Assurance Company Limited
Nestlife Assurance Corporation Limited
Netcare Life Limited
New Era Life Insurance Company Limited
NIB Life Assurance Company Limited
Nova Life Partners Limited
Old Mutual Alternative Risk Transfer Limited
Old Mutual Life Assurance Company (South Africa) Limited
Pinnafrica Life Limited
Precient Life Limited
Professional Provident Society Insurance Company Limited
Prosperity Insurance Company Limited
Real People Assurance Company Limited
Regent Life Assurance Company Limited
Relyant Life Assurance Company Limited
RMA Life Assurance Company Limited
RMB Structured Life Limited
SA Eagle Life Limited
Safrican Insurance Company Limited
SAHL Life Assurance Company Limited
Sanlam Customised Insurance Limited
Sanlam Life Insurance Limited

Sekunjalo Life Limited
Sentry Assurance of South Africa Limited
Standard General Insurance Company Limited
Stanlib Multi Manager Limted
Superflex Limited
Sygnia Life Limited
Ten-50-Six Life Limited
Universal Assurance Company Limited

List of Registered Reinsurers

African Reinsurance Corporation (SA) Limited
General Reinsurance Africa Ltd
Hannover Life Reassurance Africa Limited
Munich Reinsurance Company of Africa Limited
RGA Reinsurance Company of South Africa Limited
Saxum Reinsurance Limited
Swiss Re Life And Health Africa Limited

APPENDIX 2 – COVERING E-MAIL

Dear Public Officer,

I am an MBA student completing my research report on Risk Management in South African Life Insurance Companies. There is no perfect approach to risk management. My aim is to investigate the basic practices of the life offices, focussing on the smaller companies and comparing the approaches taken by small and large companies, without getting into the detail of the calculations and exact measurements.

I would appreciate it if you could forward this e-mail to the best person I your company to complete the questionnaire. The questionnaire should not take longer than 20 minutes to complete. On completion of my report, I will circulate the results to all the participants. This may be useful to you in your risk management.

I do not expect that you would be disclosing any competitor sensitive information, but in case you disagree with me, I need to disclose that I have subsequently to embarking on this research been appointed as a non-executive director of a small insurance company. If you want to participate anonomously, please send the questionnaire to Prof. Bill Haslam at william.haslam@wits.ac.za. He has kindly agreed to collect the information and remove any evidence that could connect the response to the company.

I would appreciate a response by 14 June 2007. I look forward to your company's response.

Regards
MARLI VENTER

APPENDIX 3 - QUESTIONNAIRE

1 Demographic data

1 Size of your company (measured by long term liabilities)

- [ ] <R1bn
- [ ] R1bn - R20bn
- [ ] >R20bn

2 Type of company (as per the classification in the FSB quarterly reports)

- [ ] Typical insurer
- [ ] Niche insurer
- [ ] Linked investment insurer
- [ ] Cell captive insurer
- [ ] Reinsurer
- [ ] Assistance insurer

3 What is your responsibility in the company?

- [ ] Chief Executive Officer
- [ ] Chief Risk Officer
- [ ] Chief Financial Officer
- [ ] Chief Actuary
- [ ] Other

If other, please specify

2 Risk environment

1 Where does the responsibility for risk management in your company lie?

- ☐ The Board of Directors
- ☐ Executive Management
- ☐ Internal Audit
- ☐ Other — If other, please specify

2 Would you describe your risk management structure as

- ☐ Formal
- ☐ Informal

3 Would you describe your risk management structure as

- ☐ Centralised
- ☐ Decentralised

4 Does your company have a formal risk management policy or strategy?

- ☐ Yes
- ☐ No

5 Has your company defined its risk appetite or tolerance for risk?

- ☐ Yes
- ☐ No

6 How are staff informed of the risk policy or strategy?

- [ ] Verbally in meetings and discussions
- [ ] Written instructions or procedures
- [ ] At the induction course
- [ ] They are not informed
- [ ] There is no risk strategy
- [ ] Other — If other, please specify

7 Are risk management objectives included in your company's incentive schemes?

- [ ] Yes
- [ ] We are thinking about it
- [ ] We have thought about it and decided not to include it
- [ ] No
- [ ] Other — If other, please specify

3 Risk assessment practices

1 How often does your company run a risk identification process?

- [ ] We have never run one
- [ ] We have never run one formally
- [ ] Once and not again
- [ ] Every two years
- [ ] Every year
- [ ] Every six months
- [ ] Other — If other, please specify

2 Which methods do you use to identify risks? (Tick as many as applicable)

- [ ] Surveys
- [ ] Workshops
- [ ] External assistance
- [ ] External benchmarks
- [ ] Other — If other, please specify

4 Insurance company risks

For each of the following risks, please indicate whether your company monitors this risk and its relative importance to your company. If a risk does not apply to your company, please tick "N/A". Definitions of the risks are included in the "definitions" sheet in this workbook, if required.

Risk	Very important	Moderately important	Not important	Do not monitor	N/A
Market and product strategy					
Distribution					
Reputation					
Pricing inadequacy					
Persistency					
Mortality & morbidity					
Expenses					
Credit					
Liquidity (trading)					
Liquidity (funding)					
Operational					
Outsourcing risk					
Human resources risk					
Internal governance and control risk					
Group risk					
Reassurance					
Asset/Liability Management					
Technical reserves					
Recognition of liabilities					
Jurisdictional and legal					
Market changes					
Catastrophe					
Market risk					
Economic risk					
Social, Technological, demographic and political changes					
Other (please specify)					

5 Risk measurement

For each of the following risks, please indicate how your company measures it. If a risk does not apply to your company, please tick "N/A".

Risk	Do not measure	Ad hoc calculation	Subjective assessment	Deterministic model	Stochastic model	N/A
Market and product strategy						
Distribution						
Reputation						
Pricing inadequacy						
Persistency						
Mortality & morbidity						
Expenses						
Credit						
Liquidity (trading)						
Liquidity (funding)						
Operational						
Outsourcing risk						
Human resources risk						
Internal governance and control risk						
Group risk						
Reassurance						
Asset/Liability Management						
Technical reserves						
Recognition of liabilities						
Jurisdictional and legal						
Market changes						
Catastrophe						
Market risk						
Economic risk						
Social, Technological, demographic and political changes						
Other (please specify)						

6 Risk responses

Risk	Risk assumption	Loss prevention	Loss reduction	Risk transfer	Risk avoidance	N/A
Market and product strategy						
Distribution						
Reputation						
Pricing inadequacy						
Persistency						
Mortality & morbidity						
Expenses						
Credit						
Liquidity (trading)						
Liquidity (funding)						
Operational						
Outsourcing risk						
Human resources risk						
Internal governance and control risk						
Group risk						
Reassurance						
Asset/Liability Management						
Technical reserves						
Recognition of liabilities						
Jurisdictional and legal						
Market changes						
Catastrophe						
Market risk						
Economic risk						
Social, Technological, demographic and political changes						
Other (please specify)						

7 Monitoring

For each of the following risks, please indicate how often the following risks are monitored.

Risk	weekly	monhtly	quarterly	annually	ad hoc	other	N/A
Market and product strategy							
Distribution							
Reputation							
Pricing inadequacy							
Persistency							
Mortality & morbidity							
Expenses							
Credit							
Liquidity (trading)							
Liquidity (funding)							
Operational							
Outsourcing risk							
Human resources risk							
Internal governance and control risk							
Group risk							
Reassurance							
Asset/Liability Management							
Technical reserves							
Recognition of liabilities							
Jurisdictional and legal							
Market changes							
Catastrophe							
Market risk							
Economic risk							
Social, Technological, demographic and political changes							
Other (please specify)							

2 For each of the following risks, please indicate the type of measures included in the monitoring.

Risk	Actual experience	Leading indicators	Supervisory reports	Other	Please specify if other	N/A
Market and product strategy						
Distribution						
Reputation						
Pricing inadequacy						
Persistency						
Mortality & morbidity						
Expenses						
Credit						
Liquidity (trading)						
Liquidity (funding)						
Operational						
Outsourcing risk						
Human resources risk						
Internal governance and control risk						
Group risk						
Reassurance						
Asset/Liability Management						
Technical reserves						
Recognition of liabilities						
Jurisdictional and legal						
Market changes						
Catastrophe						
Market risk						
Economic risk						
Social, Technological, demographic and political changes						
Other (please specify)						

APPENDIX 4 – SPSS RESULTS: RESPONSES

```
NPAR TESTS
  /K-S= Size   BY Group(0 1)
  /MISSING ANALYSIS.
```

NPar Tests

```
[DataSet2] F:\MBA Stats\Response data.sav
```

Two-Sample Kolmogorov-Smirnov Test

Frequencies

	Group	N
Size	0	44
	1	17
	Total	61

Test Statistics(a)

		Size
Most Extreme Differences	Absolute	.365
	Positive	.365
	Negative	.000
Kolmogorov-Smirnov Z		1.278
Asymp. Sig. (2-tailed)		.076

a Grouping Variable: Group

APPENDIX 5 – SPSS RESULTS: ENVIRONMENT

```
NPAR TEST
  /CHISQUARE=Formal Central Policy Appetite
  /EXPECTED=EQUAL
  /MISSING ANALYSIS.
```

NPar Tests

```
[DataSet4] F:\MBA Stats\Environment.sav
```

Chi-Square Test

Frequencies

Formal

	Observed N	Expected N	Residual
1	12	8.5	3.5
2	5	8.5	-3.5
Total	17		

Central

	Observed N	Expected N	Residual
1	10	8.5	1.5
2	7	8.5	-1.5
Total	17		

Policy

	Observed N	Expected N	Residual
1	14	8.5	5.5
2	3	8.5	-5.5
Total	17		

Appetite

	Observed N	Expected N	Residual
1	13	8.5	4.5
2	4	8.5	-4.5
Total	17		

Test Statistics

	Formal	Central	Policy	Appetite
Chi-Square(a)	2.882	.529	7.118	4.765
df	1	1	1	1
Asymp. Sig.	.090	.467	.008	.029

a 0 cells (.0%) have expected frequencies less than 5. The minimum expected cell frequency is 8.5.

```
CROSSTABS
  /TABLES=Formal  BY Central
  /FORMAT= AVALUE TABLES
  /STATISTIC=CHISQ
  /CELLS= COUNT
  /COUNT ROUND CELL .
```

Crosstabs

[DataSet4] F:\MBA Stats\Environment.sav

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Formal * Central	17	100.0%	0	.0%	17	100.0%

Formal * Central Crosstabulation

Count

		Central		Total
		1	2	1
Formal	1	8	4	12
	2	2	3	5
Total		10	7	17

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	1.036(b)	1	.309		
Continuity Correction(a)	.228	1	.633		
Likelihood Ratio	1.028	1	.311		
Fisher's Exact Test				.593	.314
Linear-by-Linear Association	.975	1	.323		
N of Valid Cases	17				

a Computed only for a 2x2 table

b 3 cells (75.0%) have expected count less than 5. The minimum expected count is 2.06.

```
CROSSTABS
  /TABLES=Policy  BY Appetite
  /FORMAT= AVALUE TABLES
  /STATISTIC=CHISQ
  /CELLS= COUNT
  /COUNT ROUND CELL .
```

Crosstabs

[DataSet4] F:\MBA Stats\Environment.sav

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Policy * Appetite	17	100.0%	0	.0%	17	100.0%

Policy * Appetite Crosstabulation

Count

		Appetite		Total
		1	2	1
Policy	1	13	1	14
	2	0	3	3
Total		13	4	17

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	11.839(b)	1	.001		
Continuity Correction(a)	7.241	1	.007		
Likelihood Ratio	11.345	1	.001		
Fisher's Exact Test				.006	.006
Linear-by-Linear Association	11.143	1	.001		
N of Valid Cases	17				

a Computed only for a 2x2 table

b 3 cells (75.0%) have expected count less than 5. The minimum expected count is .71.

APPENDIX 6 – SPSS RESULTS: CORRELATION WITH IMPORTANCE OF RISKS

```
CROSSTABS
  /TABLES=Type  BY Importance
  /FORMAT= AVALUE TABLES
  /STATISTIC=PHI LAMBDA
  /CELLS= COUNT
  /COUNT ROUND CELL .
```

Crosstabs

[DataSet3] F:\MBA Stats\Correlation.sav

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Type * Importance	371	87.3%	54	12.7%	425	100.0%

Type * Importance Crosstabulation

Count

		Importance				Total
		1	2	3	4	1
Type	1	4	9	7	17	37
	2	19	13	7	0	39
	3	74	70	15	2	161
	4	67	27	2	1	97
	5	31	6	0	0	37
Total		195	125	31	20	371

Directional Measures

			Value	Asymp. Std. Error(a)	Approx. T(b)	Approx. Sig.
Nominal by Nominal	Lambda	Symmetric	.073	.021	3.302	.001
		Type Dependent	.071	.020	3.498	.000
		Importance Dependent	.074	.025	2.868	.004
	Goodman and Kruskal tau	Type Dependent	.090	.016		.000(c)
		Importance Dependent	.112	.022		.000(c)

a Not assuming the null hypothesis.
b Using the asymptotic standard error assuming the null hypothesis.
c Based on chi-square approximation

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.693	.000
	Cramer's V	.400	.000
N of Valid Cases		371	

a Not assuming the null hypothesis.
b Using the asymptotic standard error assuming the null hypothesis.

```
CROSSTABS
  /TABLES=Frequency  BY Importance
  /FORMAT= AVALUE TABLES
  /STATISTIC=CORR
  /CELLS= COUNT
  /COUNT ROUND CELL .
```

Crosstabs

```
[DataSet3] F:\MBA Stats\Correlation.sav
```

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Frequency * Importance	369	86.8%	56	13.2%	425	100.0%

Frequency * Importance Crosstabulation

Count

		Importance				Total
		1	2	3	4	1
Frequency	1	18	6	2	0	26
	2	53	30	6	0	89
	3	63	36	7	0	106
	4	20	16	6	1	43
	5	40	37	10	18	105
Total		194	125	31	19	369

Symmetric Measures

		Value	Asymp. Std. Error(a)	Approx. T(b)	Approx. Sig.
Interval by Interval	Pearson's R	.292	.047	5.839	.000(c)
Ordinal by Ordinal	Spearman Correlation	.242	.051	4.782	.000(c)
N of Valid Cases		369			

a Not assuming the null hypothesis.
b Using the asymptotic standard error assuming the null hypothesis.
c Based on normal approximation.

APPENDIX 7 – SPSS RESULTS: ENVIRONMENT BY SIZE

```
DATASET ACTIVATE DataSet4.
DATASET CLOSE DataSet1.
GET
  FILE='F:\MBA Stats\Identify.sav'.
DATASET NAME DataSet5 WINDOW=FRONT.
DATASET ACTIVATE DataSet4.
DATASET CLOSE DataSet5.
CROSSTABS
  /TABLES=Formal Central Policy Appetite Verbal Written Induction Incentive
   BY SL
  /FORMAT= AVALUE TABLES
  /STATISTIC=CHISQ
  /CELLS= COUNT
  /COUNT ROUND CELL .
```

Crosstabs

[DataSet4] F:\MBA Stats\Environment.sav

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Formal * SL	17	100.0%	0	.0%	17	100.0%
Central * SL	17	100.0%	0	.0%	17	100.0%
Policy * SL	17	100.0%	0	.0%	17	100.0%
Appetite * SL	17	100.0%	0	.0%	17	100.0%
Verbal * SL	17	100.0%	0	.0%	17	100.0%
Written * SL	17	100.0%	0	.0%	17	100.0%
Induction * SL	17	100.0%	0	.0%	17	100.0%
Incentive * SL	17	100.0%	0	.0%	17	100.0%

Formal * SL

Crosstab

Count

		SL		Total
		1	2	1
Formal	1	5	7	12
	2	3	2	5
Total		8	9	17

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.476(b)	1	.490		
Continuity Correction(a)	.025	1	.875		
Likelihood Ratio	.477	1	.490		
Fisher's Exact Test				.620	.437
Linear-by-Linear Association	.448	1	.503		
N of Valid Cases	17				

a Computed only for a 2x2 table
b 2 cells (50.0%) have expected count less than 5. The minimum expected count is 2.35.

Central * SL

Crosstab

Count

		SL		Total
		1	2	1
Central	1	6	4	10
	2	2	5	7
Total		8	9	17

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	1.633(b)	1	.201		
Continuity Correction(a)	.615	1	.433		
Likelihood Ratio	1.672	1	.196		
Fisher's Exact Test				.335	.218
Linear-by-Linear Association	1.537	1	.215		
N of Valid Cases	17				

a Computed only for a 2x2 table
b 3 cells (75.0%) have expected count less than 5. The minimum expected count is 3.29.

Policy * SL

Crosstab

Count

		SL		Total
		1	2	1
Policy	1	5	9	14
	2	3	0	3
Total		8	9	17

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	4.098(b)	1	.043		
Continuity Correction(a)	1.924	1	.165		
Likelihood Ratio	5.259	1	.022		
Fisher's Exact Test				.082	.082
Linear-by-Linear Association	3.857	1	.050		
N of Valid Cases	17				

a Computed only for a 2x2 table
b 2 cells (50.0%) have expected count less than 5. The minimum expected count is 1.41.

Appetite * SL

Crosstab

Count

		SL		Total
		1	2	1
Appetite	1	5	8	13
	2	3	1	4
Total		8	9	17

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	1.639(b)	1	.200		
Continuity Correction(a)	.501	1	.479		
Likelihood Ratio	1.686	1	.194		
Fisher's Exact Test				.294	.241
Linear-by-Linear Association	1.543	1	.214		
N of Valid Cases	17				

a Computed only for a 2x2 table
b 2 cells (50.0%) have expected count less than 5. The minimum expected count is 1.88.

Verbal * SL

Crosstab

Count

		SL		Total
		1	2	1
Verbal	0	4	0	4
	1	4	9	13
Total		8	9	17

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	5.885(b)	1	.015		
Continuity Correction(a)	3.434	1	.064		
Likelihood Ratio	7.460	1	.006		
Fisher's Exact Test				.029	.029
Linear-by-Linear Association	5.538	1	.019		
N of Valid Cases	17				

a Computed only for a 2x2 table
b 2 cells (50.0%) have expected count less than 5. The minimum expected count is 1.88.

Written * SL

Crosstab

Count

		SL		Total
		1	2	1
Written	0	3	4	7
	1	5	5	10
Total		8	9	17

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.084(b)	1	.772		
Continuity Correction(a)	.000	1	1.000		
Likelihood Ratio	.084	1	.771		
Fisher's Exact Test				1.000	.581
Linear-by-Linear Association	.079	1	.778		
N of Valid Cases	17				

a Computed only for a 2x2 table
b 3 cells (75.0%) have expected count less than 5. The minimum expected count is 3.29.

Induction * SL

Crosstab

Count

		SL		Total
		1	2	1
Induction	0	8	6	14
	1	0	3	3
Total		8	9	17

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	3.238(b)	1	.072		
Continuity Correction(a)	1.351	1	.245		
Likelihood Ratio	4.387	1	.036		
Fisher's Exact Test				.206	.124
Linear-by-Linear Association	3.048	1	.081		
N of Valid Cases	17				

a Computed only for a 2x2 table

b 2 cells (50.0%) have expected count less than 5. The minimum expected count is 1.41.

Incentive * SL

Crosstab

Count

		SL		Total
		1	2	1
Incentive	1	2	3	5
	2	1	1	2
	4	5	5	10
Total		8	9	17

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	.142(a)	2	.932
Likelihood Ratio	.142	2	.931
Linear-by-Linear Association	.105	1	.746
N of Valid Cases	17		

a 5 cells (83.3%) have expected count less than 5. The minimum expected count is .94.

APPENDIX 8 – SPSS RESULTS: RISK ASSESSMENT BY SIZE

```
NPAR TESTS
  /K-S= Often   BY SL(1 2)
  /MISSING ANALYSIS.
```

NPar Tests

```
[DataSet6] F:\MBA Stats\Assessment.sav
```

Two-Sample Kolmogorov-Smirnov Test

Frequencies

	SL	N
Often	1	8
	2	9
	Total	17

Test Statistics(a)

		Often
Most Extreme Differences	Absolute	.639
	Positive	.000
	Negative	-.639
Kolmogorov-Smirnov Z		1.315
Asymp. Sig. (2-tailed)		.063

a Grouping Variable: SL

```
CROSSTABS
  /TABLES=Survey Workshop Assist Benchmark  BY SL
  /FORMAT= AVALUE TABLES
  /STATISTIC=CHISQ
  /CELLS= COUNT
  /COUNT ROUND CELL .
```

Crosstabs

[DataSet6] F:\MBA Stats\Assessment.sav

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Survey * SL	17	100.0%	0	.0%	17	100.0%
Workshop * SL	17	100.0%	0	.0%	17	100.0%
Assist * SL	17	100.0%	0	.0%	17	100.0%
Benchmark * SL	17	100.0%	0	.0%	17	100.0%

Survey * SL

Crosstab

Count

		SL		Total
		1	2	1
Survey	0	7	6	13
	1	1	3	4
Total		8	9	17

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	1.022(b)	1	.312		
Continuity Correction(a)	.192	1	.661		
Likelihood Ratio	1.065	1	.302		
Fisher's Exact Test				.576	.335
Linear-by-Linear Association	.962	1	.327		
N of Valid Cases	17				

a Computed only for a 2x2 table

b 2 cells (50.0%) have expected count less than 5. The minimum expected count is 1.88.

Workshop * SL

Crosstab

Count

		SL		Total
		1	2	1
Workshop	0	2	1	3
	1	6	8	14
Total		8	9	17

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.562(b)	1	.453		
Continuity Correction(a)	.013	1	.910		
Likelihood Ratio	.568	1	.451		
Fisher's Exact Test				.576	.453
Linear-by-Linear Association	.529	1	.467		
N of Valid Cases	17				

a Computed only for a 2x2 table
b 2 cells (50.0%) have expected count less than 5. The minimum expected count is 1.41.

Assist * SL

Crosstab

Count

		SL		Total
		1	2	1
Assist	0	4	4	8
	1	4	5	9
Total		8	9	17

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.052(b)	1	.819		
Continuity Correction(a)	.000	1	1.000		
Likelihood Ratio	.052	1	.819		
Fisher's Exact Test				1.000	.601
Linear-by-Linear Association	.049	1	.824		
N of Valid Cases	17				

a Computed only for a 2x2 table
b 4 cells (100.0%) have expected count less than 5. The minimum expected count is 3.76.

Benchmark * SL

Crosstab

Count

		SL		Total
		1	2	1
Benchmark	0	6	7	13
	1	2	2	4
Total		8	9	17

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.018(b)	1	.893		
Continuity Correction(a)	.000	1	1.000		
Likelihood Ratio	.018	1	.893		
Fisher's Exact Test				1.000	.665
Linear-by-Linear Association	.017	1	.896		
N of Valid Cases	17				

a Computed only for a 2x2 table

b 2 cells (50.0%) have expected count less than 5. The minimum expected count is 1.88.

APPENDIX 9 – SPSS RESULTS: RISKS BY SIZE

```
NPAR TESTS
  /K-S= VAR00001 VAR00002 VAR00003 VAR00004 VAR00005   BY SL(1 2)
  /MISSING ANALYSIS.
```

NPar Tests

```
[DataSet11] F:\MBA Stats\Risks.sav
```

Two-Sample Kolmogorov-Smirnov Test

Frequencies

	SL	N
VAR00001	1	7
	2	9
	Total	16
VAR00002	1	5
	2	8
	Total	13
VAR00003	1	8
	2	9
	Total	17
VAR00004	1	8
	2	9
	Total	17
VAR00005	1	7
	2	9
	Total	16

Test Statistics(a)

		VAR00001	VAR00002	VAR00003	VAR00004	VAR00005
Most Extreme Differences	Absolute	.175	.275	.278	.222	.143
	Positive	.175	.275	.278	.000	.143
	Negative	-.159	.000	.000	-.222	-.016
Kolmogorov-Smirnov Z		.346	.482	.572	.457	.283
Asymp. Sig. (2-tailed)		1.000	.974	.899	.985	1.000

a Grouping Variable: SL

```
NPAR TESTS
  /K-S= VAR00006 VAR00007 VAR00008 VAR00009 VAR00010   BY SL(1 2)
  /MISSING ANALYSIS.
```

NPar Tests

```
[DataSet11] F:\MBA Stats\Risks.sav
```

Two-Sample Kolmogorov-Smirnov Test

Frequencies

	SL	N
VAR00006	1	7
	2	8
	Total	15
VAR00007	1	8
	2	9
	Total	17
VAR00008	1	7
	2	8
	Total	15
VAR00009	1	6
	2	9
	Total	15
VAR00010	1	7
	2	9
	Total	16

Test Statistics(a)

		VAR00006	VAR00007	VAR00008	VAR00009	VAR00010
Most Extreme Differences	Absolute	.107	.194	.232	.444	.127
	Positive	.000	.000	.232	.444	.127
	Negative	-.107	-.194	-.125	-.222	-.111
Kolmogorov-Smirnov Z		.207	.400	.449	.843	.252
Asymp. Sig. (2-tailed)		1.000	.997	.988	.476	1.000

a Grouping Variable: SL

```
NPAR TESTS
  /K-S= VAR00011 VAR00012 VAR00013 VAR00014 VAR00015   BY SL(1 2)
  /MISSING ANALYSIS.
```

NPar Tests

```
[DataSet11] F:\MBA Stats\Risks.sav
```

Two-Sample Kolmogorov-Smirnov Test

Frequencies

	SL	N
VAR00011	1	8
	2	9
	Total	17
VAR00012	1	8
	2	8
	Total	16
VAR00013	1	8
	2	9
	Total	17
VAR00014	1	8
	2	9
	Total	17
VAR00015	1	7
	2	8
	Total	15

Test Statistics(a)

		VAR00011	VAR00012	VAR00013	VAR00014	VAR00015
Most Extreme Differences	Absolute	.111	.125	.111	.319	.286
	Positive	.028	.000	.056	.000	.286
	Negative	-.111	-.125	-.111	-.319	-.054
Kolmogorov-Smirnov Z		.229	.250	.229	.657	.552
Asymp. Sig. (2-tailed)		1.000	1.000	1.000	.780	.921

a Grouping Variable: SL

```
NPAR TESTS
  /K-S= VAR00016 VAR00017 VAR00018 VAR00019 VAR00020   BY SL(1 2)
  /MISSING ANALYSIS.
```

NPar Tests

```
[DataSet11] F:\MBA Stats\Risks.sav
```

Two-Sample Kolmogorov-Smirnov Test

Frequencies

	SL	N
VAR00016	1	6
	2	6
	Total	12
VAR00017	1	7
	2	8
	Total	15
VAR00018	1	8
	2	8
	Total	16
VAR00019	1	8
	2	8
	Total	16
VAR00020	1	8
	2	9
	Total	17

Test Statistics(a)

		VAR00016	VAR00017	VAR00018	VAR00019	VAR00020
Most Extreme Differences	Absolute	.167	.107	.000	.000	.528
	Positive	.167	.000	.000	.000	.528
	Negative	.000	-.107	.000	.000	.000
Kolmogorov-Smirnov Z		.289	.207	.000	.000	1.086
Asymp. Sig. (2-tailed)		1.000	1.000	1.000	1.000	.189

a Grouping Variable: SL

```
NPAR TESTS
  /K-S= VAR00021 VAR00022 VAR00023 VAR00024 VAR00025   BY SL(1 2)
  /MISSING ANALYSIS.
```

NPar Tests

```
[DataSet11] F:\MBA Stats\Risks.sav
```

Two-Sample Kolmogorov-Smirnov Test

Frequencies

	SL	N
VAR00021	1	8
	2	9
	Total	17
VAR00022	1	8
	2	9
	Total	17
VAR00023	1	7
	2	9
	Total	16
VAR00024	1	8
	2	9
	Total	17
VAR00025	1	8
	2	9
	Total	17

Test Statistics(a)

		VAR00021	VAR00022	VAR00023	VAR00024	VAR00025
Most Extreme Differences	Absolute	.250	.250	.460	.250	.403
	Positive	.250	.250	.460	.250	.403
	Negative	-.056	-.042	.000	.000	.000
Kolmogorov-Smirnov Z		.514	.514	.913	.514	.829
Asymp. Sig. (2-tailed)		.954	.954	.374	.954	.498

a Grouping Variable: SL

APPENDIX 10 – SPSS RESULTS: MONITORING

```
NPAR TESTS
  /K-S= VAR00001 VAR00002 VAR00003 VAR00004 VAR00005   BY SL(1 2)
  /MISSING ANALYSIS.
```

NPar Tests

```
[DataSet14]
```

Two-Sample Kolmogorov-Smirnov Test

Frequencies

	SL	N
VAR00001	1	8
	2	9
	Total	17
VAR00002	1	8
	2	9
	Total	17
VAR00003	1	8
	2	9
	Total	17
VAR00004	1	8
	2	9
	Total	17
VAR00005	1	8
	2	9
	Total	17

Test Statistics(a)

		VAR00001	VAR00002	VAR00003	VAR00004	VAR00005
Most Extreme Differences	Absolute	.167	.222	.222	.403	.278
	Positive	.167	.222	.111	.403	.278
	Negative	-.028	.000	-.222	-.264	-.278
Kolmogorov-Smirnov Z		.343	.457	.457	.829	.572
Asymp. Sig. (2-tailed)		1.000	.985	.985	.498	.899

a Grouping Variable: SL

```
NPAR TESTS
  /K-S= VAR00006 VAR00007 VAR00008 VAR00009 VAR00010   BY SL(1 2)
  /MISSING ANALYSIS.
```

NPar Tests

```
[DataSet14]
```

Two-Sample Kolmogorov-Smirnov Test

Frequencies

	SL	N
VAR00006	1	8
	2	9
	Total	17
VAR00007	1	8
	2	9
	Total	17
VAR00008	1	8
	2	9
	Total	17
VAR00009	1	8
	2	9
	Total	17
VAR00010	1	8
	2	9
	Total	17

Test Statistics(a)

		VAR00006	VAR00007	VAR00008	VAR00009	VAR00010
Most Extreme Differences	Absolute	.181	.125	.278	.181	.097
	Positive	.028	.056	.111	.139	.083
	Negative	-.181	-.125	-.278	-.181	-.097
Kolmogorov-Smirnov Z		.372	.257	.572	.372	.200
Asymp. Sig. (2-tailed)		.999	1.000	.899	.999	1.000

a Grouping Variable: SL

```
NPAR TESTS
  /K-S= VAR00011 VAR00012 VAR00013 VAR00014 VAR00015   BY SL(1 2)
  /MISSING ANALYSIS.
```

NPar Tests

```
[DataSet14]
```

Two-Sample Kolmogorov-Smirnov Test

Frequencies

	SL	N
VAR00011	1	8
	2	9
	Total	17
VAR00012	1	8
	2	9
	Total	17
VAR00013	1	8
	2	9
	Total	17
VAR00014	1	8
	2	9
	Total	17
VAR00015	1	8
	2	9
	Total	17

Test Statistics(a)

		VAR00011	VAR00012	VAR00013	VAR00014	VAR00015
Most Extreme Differences	Absolute	.181	.444	.319	.153	.208
	Positive	.181	.000	.319	.153	.111
	Negative	-.111	-.444	-.111	-.111	-.208
Kolmogorov-Smirnov Z		.372	.915	.657	.314	.429
Asymp. Sig. (2-tailed)		.999	.373	.780	1.000	.993

a Grouping Variable: SL

```
NPAR TESTS
  /K-S= VAR00016 VAR00017 VAR00018 VAR00019 VAR00020   BY SL(1 2)
  /MISSING ANALYSIS.
```

NPar Tests

```
[DataSet14]
```

Two-Sample Kolmogorov-Smirnov Test

Frequencies

	SL	N
VAR00016	1	8
	2	9
	Total	17
VAR00017	1	8
	2	9
	Total	17
VAR00018	1	8
	2	9
	Total	17
VAR00019	1	8
	2	9
	Total	17
VAR00020	1	8
	2	9
	Total	17

Test Statistics(a)

		VAR00016	VAR00017	VAR00018	VAR00019	VAR00020
Most Extreme Differences	Absolute	.306	.208	.514	.222	.250
	Positive	.111	.111	.000	.153	.139
	Negative	-.306	-.208	-.514	-.222	-.250
Kolmogorov-Smirnov Z		.629	.429	1.058	.457	.514
Asymp. Sig. (2-tailed)		.824	.993	.213	.985	.954

a Grouping Variable: SL

```
NPAR TESTS
  /K-S= VAR00021 VAR00022 VAR00023 VAR00024 VAR00025   BY SL(1 2)
  /MISSING ANALYSIS.
```

NPar Tests

```
[DataSet14]
```

Two-Sample Kolmogorov-Smirnov Test

Frequencies

	SL	N
VAR00021	1	8
	2	9
	Total	17
VAR00022	1	8
	2	9
	Total	17
VAR00023	1	8
	2	9
	Total	17
VAR00024	1	8
	2	9
	Total	17
VAR00025	1	8
	2	9
	Total	17

Test Statistics(a)

		VAR00021	VAR00022	VAR00023	VAR00024	VAR00025
Most Extreme Differences	Absolute	.319	.264	.264	.375	.264
	Positive	.319	.264	.264	.153	.264
	Negative	-.111	-.250	-.264	-.375	-.250
Kolmogorov-Smirnov Z		.657	.543	.543	.772	.543
Asymp. Sig. (2-tailed)		.780	.930	.930	.591	.930

a Grouping Variable: SL