A CASE STUDY OF THE APPLICABILITY AND RELEVANCE OF A BUSINESS RISK MANAGEMENT FRAMEWORK IN A HIGHER EDUCATION QUALITY MANAGEMENT

By

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DECLARATION

I hereby declare that this thesis is my own unaided work and that any assistance obtained has been fully acknowledged in the text. No part of this thesis has been previously submitted to any other University.

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ABSTRACT

Recent local and international concerns by stakeholders for quality in for-profit (such as business firms) and not-for profit institutions (such as universities) are demanding greater oversight of the key risks they face. One regulatory reform, particularly King III Report in South Africa, now significantly requires the expansion of public and private policies relating to effective institutional governance. This reform is geared towards assuming specific risk management responsibilities with respect to responding and ensuring that institutional quality is preserved and enhanced. One response to this growing reform is the emergence of a new paradigm, which is known as institutional risk management (IRM), designed to increase quality, create awareness, identify, mitigate, monitor and report the portfolio of risks facing an institution. In view of the above reform, the study explores the applicability and relevance of an institutional risk management framework for enhancing higher education institutions' (HEIs) quality management framework (QMF).

This IRM framework forms the lens through which this study explores its relevance and applicability in an HEI context. It was conducted in a historically black South African University. The study employed a mixed research design using both questionnaires (64 respondents) and interviews to elicit the state of the institution's risk analysts' experiences. During the one and half months of data collection, the process sought to address research questions three and four. The data analyses involved both descriptive and inferencial statistical techniques including other mathematical methods. Meanwhile, literature addressed questions one two and five.

One of the findings was that IRM could be used to improve an organisation's performance and enhance QMF in an HEI. This framework would include; risk awareness; systematic risk identification and prioritisation; risk mitigation; risk monitoring and reporting; risk planning and operation; and systematic risk measure in an institution. In addition, the research found that the 'case-institution' in the study had not developed and

documented institutional risk management policy and procedures for the use of all staff –thus lacking a close link between institutional risk policies/procedures and its strategic objectives. In addition, the University does well in all the five IRM processes, but, on risk identification, it is relatively weak compared to the rest, thus in both upside and downside risk. Furthermore, although, there are several IRM models that form all IRM framework used in for-profit institutions (banks) as literature revealed, such were not found in the University under study. Another finding also noted that risks in a dynamic institution such as a University could be measured and predicted to enhance quality through risk management models such as the Nicholas risk management model, Bayesian analysis and other statistical measures.

In view of the above findings, the study recommends firstly that IRM framework be applied to a non-profit institution such as an HEI. Secondly, although, there were several models that form IRM framework which is used in the for-profit institutions as literature revealed, such (models that form IRM framework) were not found in the University; hence, it is recommended IRM framework be adopted in a South African University context. Thirdly, although Nicholas and Bayesian risk analysis models, which form part of IRM framework, were used to measure and predict risks, these did not incorporate one factor - the rate of change of risk factor with respect to time. Consequently, it is recommended that periodic surveys be conducted on the IRM variables to see how change occurs over time, while suggesting that management set targets for both upside and downside indicators of risk management. Hence, for future research, it is recommended that a particular technique is used to measure and predict risks with the consideration of rate of change of risks (i.e. time and dynamic nature).

Key words: Risk Management, Risks Measures, Risk Prediction, Quality Assurance.

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DEDICATION

To

JAWAD BAYAGA AND AFRIKA BAYAGA

ACRONYMS

Chief Executive Officers	CEOs
Chief Financial Officer	CFO
Chief Risk Officers	CROs
Committee of Sponsoring Organisations	COSO
Composite Risk Likelihood Factor	ICRLF
Council on Higher Education	CHE
Deputy Vice Chancellor	DVC
Exceedance Probability	EP
Expected Value Theory	EVT
Executive Management Team	EMT
Factorial Modeling	FaM
Higher Education Funding Council for England	HEFCE
Higher Education Institution	HEI
Higher Education Quality Committee	HEQC
Human Errors	HEs
Human interaction	HI
Human Reliability Analysis	HRA
Human Resource Officer	CHRO
Institutional-wide Risk Management	IRM
Initiating Event	IE
Key Performance Indicators	KPIs
Key Success Factors	KSFs
Mission Statement	MS
Mean/Variance/Covariance MVC	
Objectives of the Institution	OBT
Organisation Risk Management	ORM

Quality Management	QM
Quality Management Framework	QMF
Safety Health and Environment Officer	SHEO
South African Higher Education Institutions	SAHEI
South African Universities	SAU
Standard Deviation	SD
Statement Vision	SV
Stochastic Differential Equation	SDE
Teaching and Learning Committee	TLC
Total Quality Management	TQM

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CHAPTER 1
BACKGROUND TO THE STUDY

1.1 INTRODUCTION

This study emanates from the growing concern of risk and risk management, both in business and in *not for-profit* organisations. The research draws from business risk management tools and techniques and assesses their applicability of risk management from the business perspective to a Higher Education Institution (HEI). The study aims at investigating the current and emerging institutional-wide risk management (IRM) framework in enhancing quality management in a higher education institution.

It has been argued that IRM is a framework that provides an approach to enhance quality, but this has been applied in *for-profit* business organisations and not in not-for profit organisations such as higher education institutions (HEIs) (Stoney 2007; Committee of Sponsoring Organisations COSO- 2004). COSO (2004: 88) defines IRM framework as:

> … [A] process, effected by institutions management, applied in strategy setting and across the institution, designed to identify potential events that may affect the entity, and manage risk to be within its risk appetite, to afford reasonable assurance regarding the achievement of institutional objectives.

COSO (2004) argues that institutions such as universities could adopt a campus-wide risk management approach for managing the financial, programmatic, environmental, societal, and reputational risks. The campus-wide risk management policy documents (if present) would require internal processes necessary to ensure that risks are appropriately managed and the appropriate risk response actions are being properly executed. In general, all institution employees are responsible for the effective management of risk. All personnel, including managers, faculty and staff, are responsible for identifying potential risks. Managers are

responsible for developing and implementing the risk response and risk action description. The risk management approach should be incorporated with other planning processes and management activities, that is, the university initiative submission process. However, that calls for a clear elaboration of framework used. In this study, IRM is a key framework. The precise defining features and dimensions are further elaborated in chapter 2: 19 (section 2.2 & 2.2.2 the characteristics of IRM & section 2.4).

The IRM perspective forms the lens through which this study explores the relevance and applicability of a business framework in an HEI context. Arising from recent local or quality in institutions, universities are demanding greater oversight of key risks facing institutions to ensure that stakeholder quality and value are preserved and/or enhanced (Council on Higher Education - CHE, 2009**;** King III Report 2009; Nicholas & Steyn, 2008; Higher Education Funding Council for England, 2001; Stoney, 2007; Standard & Poor, 2006; Higher Education Quality Committee - HEQC 2004; Alessandri, Ford, Lander, Leggio, & Taylor, 2004; Artzner, Delbaen, Eber & Heath, 1999; Harvey & Green, 1993). Numerous regulatory reforms particularly the HEQC (2004) and the King III Report (2009) in South Africa, are now significantly expanding public and private policies related to effective institutional governance. Recent changes in the King III Report (2009) on quality of corporate governance rules now include the urgent requirements and expectations for South African institutions to assume specific responsibilities with respect to risk management to enhance quality. The reason being that if quality mechanisms are not in place to effectively manage the ever-changing portfolio of risks facing institutions, institutions are at risk.

1.2 EVOLUTION OF INSTITUTIONAL WIDE RISK MANAGEMENT FRAMEWORK

A point with regard to conceptual clarity relates to use of *model* and *framework* in the current study. In parts of the study, it is important to acknowledge that these terms seem to be used rather loosely. Strictly speaking though, for this study a framework is a hypothetical description

of a complex entity or process. In general, a framework is a real or conceptual structure intended to serve as a support or guide for the building of something that expands the structure into something useful. However, a model is used in this study to refer to that which helps highlight important connections in systems and processes (cf. section 2.4). Models are used as a first step in the development of more complex models that form a framework. Thus, IRM is a risk management framework encompasses a number of models (cf. ch 2: 19: 19 section 2.4 & sections 5.2-5.3).

Growing expectation of regulatory reform in institutional governance resulted in the emergence of a new paradigm shift known as institutional risk management (IRM) ([1]Bayaga, 2010a; Nicholas & Steyn, 2008; Stoney, 2007; CHE, 2006). The essence as suggested by literature was to increase the ability of management to create awareness of risk, identify, mitigate, monitor and report the portfolio of risks facing an institution (Nicholas & Steyn, 2008; Stoney, 2007; CHE, 2006) (cf. chs 2 & 5 for details of the variables). Survey of literature (Nicholas & Steyn, 2008; Stoney, 2007; CHE, 2006; McNeil, Fred & Embrechts, 2005; Standard & Poor, 2005; Nicholas, 2004; Crouhy, Galai & Mark, 2001; HEFCE, 2001) suggest that IRM has metamorphosed in to a variety of forms. While, some studies (COSO, 2004; Liebenberg & Hoyt, 2003; PricewaterhouseCoopers - PwC, 2004) refer to it as enterprise risk management, others (Bayaga & Moyo, 2009**;** Stoney, 2007; HEFCE, 2007**)** refer to it as quality risk management. Yet, there are scholars **(**Power, 2004; Reason, 2000) who would prefer to term the concept as

[1] For similar publications of Bayaga (2009, 2010) see appendix F for the following publications

- **Bayaga, A.** and Flowerday, S. **(2010).** *A Conceptual Operational Risk Model for SMEs: Impact on Organisational Information Technology*. ISSA 2010 Program Committee. Conference Proceedings published by the IEEE (1-8).
- **Bayaga, A.** and Moyo, G**. (2009).** An Investigation into the Relevance and Applicability of University-wide Risk Awareness: Effect of Risk Policies and Procedures. *The Journal of International Social Research,* 2(9), 53-73.
- Bayaga, A. (2010a) Quantitative Risk Analysis: Method and Process. *Romanian Statistical Review,* 3, pp 49-56
- Bayaga, A. (2010b). Determinants of Institutional Objectives and Risk Identification: Relative Relationship – Case of a University, *The Journal of International Social Research,* 3(11), pp125-136.
- And others not included in this thesis.

institutional risk management (IRM) or organisation risk management (ORM). It is important to acknowledge the variation and/or evolution of IRM as total quality management (TQM); which aims to address institutional quality. However, the difference between IRM and TQM lies in modeling, quantification and prediction of risk (cf. chs. 2: 19, (cf. section 2.4). While, in this study IRM uses mathematical and mainly statistical models, the modeling of TQM emanates from subjective bases (cf. chs 3: 57 section 3.2-3.3). Thus, in many organisations, "quality management" is transforming into IRM. But, for the purpose of this study, the researcher adapts and adopts IRM. In any case, all of the authors suggest that the concept is engineered to manage quality or risk of some sort. Hence, writers such as (King III Report (2009), Stoney (2007), McNeil et al. (2005), Standard and Poor (2006), PwC (2004), Liebenberg and Hoyt (2003) and HEFCE (2001) also assert that IRM serves the purpose of quality management.

1.3 QUALITY MANAGEMENT CONCEPTIONS

This section considers various conceptions of quality in higher education, looking at their value as well as their shortcomings in a variety of contexts. It proposes that the advantages of using an institution-wide risk management (IRM) framework (cf. chs. 2-3) be explored, in an attempt to compensate for some of the shortcomings presently being used in higher education institutions.

Various studies[2] (Stoney, 2007; CHE, 2006; McNeil et al., 2005; Standard & Poor, 2005; HEFCE, 2001) have reported that there is currently no common understanding of the concept of quality in higher education. The authors assert that the more an institution is complex, many-folded or abstract, the more difficult it is to come up with a satisfactory understanding of quality. On the other hand and relying on

[2] Also see http://www.che.ac.za/auditing/2009; www.education.gov.za/QL/QLTC. http://www.che.ac.za/heqcisinfo/2009; King III- which is an abbreviated name for the King Report on Corporate Governance for South Africa, published 2002 in South Africa. It indicates that institutions have to comply with King II which itself requires compliance with Global Reporting Initiative guidelines. See also Basel II (Basel Accords), and ISO 9001, Sarbanes-Oxley Act of 2002 and ISO 9000; which is a family of standards for quality management systems. ISO 9000 or ISO 9001.

suggestions offered by present and past authors (Stoney 2007; Higher Education Quality Committee - HEQC, 2004; Speckman & Davis, 2004; HEFCE, 2001; Green, 1993; Harvey & Green, 1993; Miller, 1992), the understanding of quality could be divided into the following five categories: Quality as 'fitness for purpose', quality as 'value for money', quality as 'threshold', quality as 'exceptionality or excellence' and quality as 'zero errors'.

Quality as fitness for purpose: This is the definition used most frequently in higher education both locally and internationally (HEQC, 2004; HEFCE, 2001). According to this concept, institutions have to decide to what extent the service or product meets the goals set. Such a definition enables institutions to define goals in their mission statements (cf. ch 6 section 6.2-6.3). Quality is then assessed and presented through mission statement (MS) and goal achievement. This usage of the concept concentrates on meeting the needs of the customers of higher education, i.e. interest groups such lecturers and administrators. This definition takes into consideration the differences which institutions instead of making them artificially resemble each other. Thus, the definition assumes that the concept and goals of higher education need to be defined. The goals of any higher education institution are presented on a general level in the mission statement and on a more concrete academic level in the programme objectives and expected learning outcomes. In other words, the institution says what it does, does what it promises and proves it to the third party.

Effectiveness is connected with the objectives of the course, whereas efficiency is connected to the resources used in order to meet a objectives. A weakness regarding this conception is that while focusing on measuring compliance to goals, is important to consider the relevance of the goal. This is the reason why, first, institutions should look at the relevance of the goal before analysing to what extent a goal has been met. It is only then we can depict the level of fitness to purpose of the institution. In this respect, the risk analysis concept may be used for institutional analysis and to ensure the relevance of the goals. One such form of a risk analysis model is using Bayesian analysis (cf. ch 5: 90: 90

section 5.2.7.2.2 Mathematical Model: Bayesian Analysis for details).

Quality as value for money: This is likened to "quality for reasonable price" and "quality at affordable price", which means that students are promised a high quality service (which could be teaching) at a fair price. The essence of this conception lies in the responsibility aspect of quality assurance. State-funded universities, for instance, are held responsible by financiers and clients. It is thought (Harvey & Green, 1993) that the key to increased cost-effectiveness is in increased competition between universities both for financing and students. One considerable drawback of this theory is that institutions struggle to maintain resources/infrastructure they need in order to meet the objectives (Harvey & Green, 1993). Thus, using risk analysis[3] objectives together with resources to meet the objective is one way to overcome the drawback mentioned above. This could be demonstrated using Nicholas' model of risk (cf. ch 2: 19 sections 2.1- 2.2 and ch 5: 90 sections 5.3.7 Risk quantification process for details).

Quality as threshold: In most South African Higher Education Institutions (SAHEI), specific standards and norms are defined (as in the HEQC, 2004). A threshold is set that the institution should cross in order to certify that instruction meets the quality standards. Standards in the form of policies, procedures and practices help to rationalise the definition of quality and make it more objective. The weakness of the above-described concept is that standards are difficult to apply under rapidly changing circumstances. Standards outdate as the reality changes more quickly than the standards can be changed. Nevertheless, almost all South African Universities (SAU) apply minimum standards that ensure a level of quality, below which no institution offering higher education should go. Minimum standards also allow comparability in higher education system. At the same time, the assumption that all university units or curricula exceed minimum standards is skewed and problematic, because

[3] It is important to note though that arguably, given the random nature of future events on HEI, risk analysis becomes somewhat problematic, in that the HEI are predominately fraught with constant changing events. Nonetheless, there are few disciplines in mathematics and probability theory, which could cater for this random nature of HEI. The field of stochastic (probability theory, statistics and the theory of stochastic processes) as Eberlein et al. (2008) offer as a solution (cf. ch. 2 & 5) plays important role in institutional-wide quantitative risk management.

it is predominantly a subjective one. Thus, once subjective, it suggests that it is open to multiple interpretations. This evidently contributes to the multiple meaning of quality as suggested by the above authors. While, goals have been set and 'quality increased' through meeting these goals, it may not be true in all instances that quality has improved. This could be attributable to different circumstances within institutions. In this regard, it is important to investigate this kind of assumption not only from subjective position, but by using both mathematical and objective probability principles. This could be done using a risk analysis framework (cf. ch 5: 90 section 5.3.7 Risk quantification process).

Quality as exceptionality or excellence: This definition sets a goal for universities and academic communities to always be the best. Belonging to the elite, they achieve better outcomes than others. In higher education one way this kind of quality is achieved is by admitting the best school-leavers according to specific rankings. Again this is based somewhat on subjective assumptions, something which often manifests in faculties which select only the 'best' grades from school. It is important to note that having students with the 'best' grades from high schools is not necessarily a good predictor for success or 'quality'. For this reason, it is important that a standard of measurement that seeks to measure the success rate be instituted through a risk analysis procedure (cf. ch 2: 19 section 2.4 & 5 section 5.2).

Quality as zero errors: This next conception defines quality as a consistently flawless outcome or perfection. In some ways this definition democratises the concept of quality; if consistency is achievable then anyone can achieve quality. The above definition is easily applicable in product industry as there are detailed standards set for the product or outcome, but when it comes to university graduates, it would be impossible to define what a flawless graduate should be. Besides that it is not the aim of university to produce identical graduates. This makes the conception too idealistic and subjective for higher education, hence the use of IRM. The point here is to use Nicholas' risk model to democratise the concept of quality. Details of the Nicholas' risk model are outlined in further chapters (cf. ch 2: 19 section 2.2 & ch 5: 90 section 5.2.7).

1.4 NEED FOR INSTITUTIONAL-WIDE RISK MANAGEMENT IN QUALITY MANAGEMENT

Institutional risk management (IRM) has received unprecedented international and local attention in recent years. In response to growing expectations for effective quality management across an entire institution, many leading institutions are abandoning their traditional framework to managing quality by silos, where quality areas are managed in isolation from one another, and are adopting an institutional risk management framework (Lam, 2006; Liebenberg & Hoyt, 2003). While, IRM is on the rise as shall be illustrated shortly, not all institutions such as in Africa and particularly South Africa Universities are adopting it. Little is known about why some institutions (such as banks and manufacturing) embrace IRM to enhance quality, while others Universities do not. Not much is known about the frameworks of IRM within Universities in South Africa, yet there is the need for institutional risk management (Stoney, 2007; King III Report, 2009; HEFCE, 2004). These concerns and need for IRM suggest that there is the need also to conduct a study of such importance to investigate these unknowns.

While, institutional risk management as a whole appears to be new concept in Africa and particular in South Africa, in a sharp contrast, a survey of European literature (COSO, 2004; Liebenberg & Hoyt, 2003; PwC, 2004; Walker et al., 2002; Lam, 2006) on IRM suggests that of 271 large institutions, 91% of institutions are building, or planning to build IRM. A little over one-tenth (11%) have completely implemented IRM (Advanced IRM). A cross-industry survey of 137 global firms by the also found that 45% have already appointed chief risk officers (CROs) or equivalent. While more than one-fifth (24%) plan to appoint a CRO in the next two years. The above statistics suggest the level of interest in institutional risk management has never been greater. Additionally, Akella, Kanakamedala and Roberts (2007) survey of 1,000 directors indicated that 76% want to spend more time on risk management. Additionally, the

rating agencies, led by Standard and Poor- S & P (2006), have also established IRM criteria for financial institutions corporations that would be applied in their corporate rating processes. In addition, the survey data indicated that 46% of Asia- Pacific chief executive officers (CEOs) strongly agree that IRM is a top priority to enhance institutional quality as compared to 28% of United States CEOs who strongly agree with that statement (PWC, 2004).

The above statistics suggest that for-profit institutions are implementing IRM processes to increase the effectiveness of their risk management activities, with the ultimate goal of increasing institutional quality. In fact, a recent survey by Liebenberg and Hoyt (2003) of insurance executives worldwide found that institutional risk management has "come of age". Their finding suggests that insurers are giving 'institutional level risk management increasing attention, high-level accountability, and clear responsibilities.'

Liebenberg and Hoyt (2003) examined characteristics of institutions and their IRM adoption status. Companies adopting IRM cited the influence of the risk manager (61%), encouragement from the board of directors (51%), as the key factors causing their adoption of IRM. Liebenberg and Hoyt (2003) used chief risk officer appointments to examine the determinants of IRM adoption. The authors found that companies appointing a chief risk officer to enhance institutional quality had higher leverage. In addition to the urgent need to enhance quality management processes with risk management, the final and important question is; what is the institutional-wide risk management potential in strategic thinking about quality? This question is important and may attract critiques, the reason being that in South Africa, the HEQC (2004) has executive responsibility for quality promotion and quality assurance in higher education. This is based on the Higher Education Act of 1997 which states that the functions of the HEQC are to: (1) promote quality in higher education (2) audit the quality assurance mechanisms of higher education institutions (3) accredit programmes of higher education (che.ac.za/about/heqc). Suggesting that there is already quality (risk) being managed through quality management

framework (QMF) thus, the question still remains important. Consequently, one may be tempted to ask the questions (1) what is quality management enhancement and (2) what difference does it make in terms of risk management? It is important to acknowledge that the essence of the contestation here is not to establish a difference as it were, but to enhance quality using risk management techniques. Whether or not there is a difference, it is important to note the enhancement of quality by using risk management models. Therefore, to address the above question(s), the researcher explicitly follows Stoneys (2007) argument relating the need for risk management techniques to enhance quality in an HEI.

With respect to the two questions, Stoney (2007) argues that the ability to identify risk factors and assess relevance and impact on a formal basis provides evidence for excellence in a competitive environment. Other authors (Standard & Poor, 2006 Nicholas, 2004) have expressed a similar view. Stoney (2007) added that IRM could be used as a tool to challenge strategy by providing a formal appraisal of the key aspects. IRM in strategic thinking constitutes the systematic application of risk management policies, procedures and practices to the tasks of establishing a context, identifying, analysing, evaluating, planning, monitoring and communicating risk to those who are potentially affected. This suggestion as the author maintains, a more consistent approach across an institution which provides the ability to compare different activities, projects initiatives and generates discussion on an informed basis.

Yet, some authors (Bayaga, 2010a; Lam, 2006 Walker et al., 2002) have wondered how risk management could be used in relation to the various quality processes. Stoney (2007) offers an answer with a prototype project, called the Good Management Practice 250 Project: Quality Risk Management in Higher Education 2005. As a solution to the critics, this project was centered on the potential for institutions to develop their own risk based approaches for the purpose of assuring quality and

standards of provision. The report[4] identified and implied that there were benefits to be gained from a risk management framework including evidence-based judgment, closer scrutiny and support of high 'risk provision', appraisal and treatment of institutional risks and supporting quality enhancement. Even so, Stoney (2007) noted that staff development was essential to equip staff with the knowledge and skills to assess and manage the range of risks that could impact on provision and that care needs to be taken to avoid a culture of blame and risk aversion (cf. findings in ch. 5 section 5.2 for details & abstract). Moreover, it was noted that risk management could be a framework for demonstrating the efficacy of internal systems, and that institutions are taking full responsibility for managing the quality and standards of provision.

1.5 MOTIVATION FOR RESEARCH QUESTIONS

Concluding from the foregoing, it could be said that with the exception of one international research (Stoney, 2007; Kleffner, Lee, & McGannon, 2003), none of these scholarly works addressed the issue of IRM in a South African University context. This study serves to investigate the enhancement of quality management with risk management procedures, by elaborating on appropriate models to be used in a university context. Even, the South African King III Report (2009) does not make explicit mention of institutions such as universities. A further search in literature offered some related scenarios. But even so the main objective was different. For instance, a study conducted by Kleffner et al. (2003) found that many (65%) companies in the finance industry are adopting IRM to quality manage the institution's procedures, thus emphasising the recent global calls for the importance of risk management. Stoney (2007) concludes that in general, approaching quality management actions by using IRM enhances quality of institution. Following the increasing demand for IRM, this research explores the question of applicability and

[4] For the entire detail of the report, see Stoney (2007) which provides a brief summary of the major findings within the case studies.

relevance of risk management in higher education quality management.

In addition, other related study by Walker et al. (2002) noted that quality management (QM) initiative cannot succeed without strong support for IRM, and a study by Lam (2006) also found that top management support for IRM to enhance QM is crucial to the success of a variety of initiatives. A further survey suggested that there is literature (Carey & Simnett, 2006; Francis, 2004; Krishnan, 2003; Myers, Myers & Omer, 2003) that examines risk management as part of QM. Despite presenting some limitations, most of those studies suggest the importance of predictive power of a risk management framework in the process of enhancing a QM framework. Anecdotal evidence suggests that certain industries are more likely to embraced IRM than others due to the relevance of IRM to the industry. For instance, banks have been leaders in IRM adoption due to the emphasis on risk management in upcoming global regulation (Basel II, 2004) as a way to reduce minimum capital requirements. Finally, educational institutions also face significant regulation and have been strongly encouraged to adopt IRM (Stoney, 2007; King III Report 2009; Standard & Poor, 2006; Whitfield, 2004). It is possible that organisations committed to engaging such high quality audits, are also more committed to quality management, the researcher examines this as well in the form of relevance of IRM in an HEI context.

In summary, institutional-wide risk management processes are needed when decisions need to be made that involve high stakes in a complex situation, where functions are being performed involving interrelated factors. Investigating a comprehensive IRM framework is essential to mitigate against the weaknesses of the above five conceptions of quality and for the rising need IRM.

1.6 PROBLEM STATEMENT

Literature suggests that a comprehensive assessment and prediction of quality and risk should be viewed as an institutional-wide effort (McNeil et al., 2005; Standard & Poor, 2006; Harvey & Green, 1993). The facts and need for institutional risk management to enhance quality management

suggest that traditional quality management does not offer stakeholders adequate assurance that an institution understands quality and the risks that may impede its ability to meet its vision and mission. Hence, due to the inadequacies and the increasing demand for IRM to enhance quality, the research adopts and adapts a risk framework (cf. chs. 2, section 2.2 what is risk and risk management; ch 3: 57, section 3.2 quality of IRM framework and models & ch 5: 90, section 5.2 & 5.3) within an HEI, to predict and hence avoid risk and sufficiently enhance the shortcomings of quality management. Following the motive of research and problem statement, the following questions are posed.

1.7 PURPOSE

The purpose of the study is to explore the applicability and relevance of a risk management framework in enhancing HEI quality management framework. The idea here is to present and establish applications in risk management decision making related to HEI, which are based on a mathematical and statistical process (models) that moves beyond the conventional subjective models used.

1.8 OBJECTIVES OF THE STUDY

1. To explore the applicability of a risk management framework in an HEI
2. To examine the relevance of business risk management framework in an HEI
3. To investigate the predictive power of risk management models within an HEI quality management framework
4. To identify an institutional-wide risk management framework that is applicable in HEI quality management.
5. To investigate the implications of IRM for quality management in a higher education institution

1.9 RESEARCH QUESTIONS

1. How applicable is a business risk management framework in a higher education institution (HEI)?
2. How relevant is a risk management framework in an HEI?
3. What predictive power do risk management models (that form IRM framework) have within an HEI quality management framework?
4. What institutional-wide risk management (IRM) framework is applicable in an HEI quality management?
5. What are the implications of IRM for quality management in a higher education institution?

1.10 SIGNIFICANCE OF THE STUDY

The significance of this study is to demonstrate how applicable and relevant practices of a risk management framework in an HEI will predict and subsequently avoid the consequences of risk, while enhancing quality. The study carried out a risk analysis exercise using risk management models within one university.

The significance here is to give a not-for profit organisation such as an HEI, an understanding of the main concepts in quantitative risk management within the general subject of risk management. Thus, it provides the opportunity to treat risk concepts analytically, but grounded in the practical problems faced by HEI.

1.11 DELIMITATION

In this study, because of the need to control numerous variables, it adopted a single university, looking at it in relation to different IRM processes, given a theoretical explanation for the models (cf. ch 3: 57 section 3.2 quality of IRM framework and models, ch 5: 90 section 5.2 & 5.3, and ch 6, section 6.4 propositions for a university – wide risk

management framework).

It is important to note, however, that the study related where appropriate to other non-HEIs. However, this study did not consider two or more Universities due to their differing social (cultural) settings, the limited time and resources available for the study.

1.12 METHODOLOGY

Methodology as Creswell and Clark (2007) describe is the interface between methodic practice, substantive theory and epistemological underpinnings, suggesting that in order to develop a methodology that commensurates with research objectives and or questions, it is imperative to clarify the researcher's position regarding ontological and epistemological themes underlining the research process. Creswell and Clark (2007) offer a synopsis of alternative research paradigms, covering positivism and interpretivism. These two provide a philosophical framework for this study (cf. ch 4: 64), thus assessing each paradigm in terms of its underlying assumptions and beliefs about the nature of reality (ontology) and the nature of knowledge (epistemology). Following the research questions, the researcher concluded that for each of the assumptions and beliefs, there is a great deal of balancing of methodology between the interpretivist and positivist paradigms. With regard to the research questions, for instance, risk analysts in both perspectives concern themselves with understanding social phenomena. However, whereas a positivist risk analyst views institutional risk analysis as technical and should be dominated by models of objectivity, governed by principles of mathematics and statistics, those of the interpretivist sees institutional risk analysis as an integrated participatory and collaborative research process designed to empower those practising IRM subjectively.

On the nature of reality of risk in a social setting, the ontological positions of the interpretivist risk analyst assume reality to be multiple, constructed, holistic and divergent. For such a risk analyst, in constructing reality, such issues as the individual and the institution itself are always embedded. Whereas a risk analyst under this paradigm views knowledge

as socially constructed and context bound, the converse is true for the positivist risk analyst. For the purpose of this study based on the research questions, a mixed methods approach therefore is used, drawing on insights from interpretivist and positivist. However, inquiry was primarily situated in the positivist paradigm. It also serves as a way of valuing multiple ways of viewing a phenomenon from differing epistemologies.

1.12.1 The Research Design

The study was a case study, designed with due consideration of Flick's (2004) ground rules for good research. These rules are based on generally agreed assumptions by the research community about what constitutes good research on matters covering the purpose, relevance, resources, originality, accuracy, accountability, generalisability, objectivity, ethics and proof (cf. ch. 4, section 4.7 research rigor).

In settling for a case study, the researcher was influenced by the nature of the research questions. The intention was to learn from a single case, the University. Creswell (2005) argues that a case study must be designed to optimise understanding of the case.

During the one and half months of data collection (cf. ch 4: 64, section 4.4), the process sought to address research questions three and four (cf. chs 5 section 5.2-5.3 & ch 6, sections 6.2 & 6.3). Meanwhile, a literature review (cf. chs. 2-3) addressed questions one, two and five. The researcher was also influenced by the research purpose, which was aimed to complement other quality enhancement techniques by applying an institutional-wide risk management (IRM) framework in HEI quality management. To serve the purpose of research questions three and four, various variables were investigated both from the questionnaire and the interview schedule as discussed in chapters 4 and 5.

1.12.2 Data Analysis

Basically, statistical analysis in this research (cf. ch 5: 90 sections 5.2-5.3) was of two types: descriptive data analysis and inferential data analysis

(Flick, 2002). The other analysis was qualitative data analysis. From the qualitative data analysis, all the interviews were transcribed and analysed using a content analysis procedure. The procedure was used, looking for themes, which emerged from the data (empirically based patterns) and the study's propositions (predicting patterns).

1.12.3 Ethical Considerations

Flick (2002) explains ethical as conforming to the standards of conduct of a given profession or group. Equally important, Flick (2002: 57) refers to ethical measures within research as:

> A set of moral principles which is suggested by an individual or group, is subsequently widely accepted, and which offers rules and behavioural expectations about the most correct conduct towards experimental subjects and respondents, employers, sponsors, other researchers, assistants and students.

Research involving human subjects is based on moral commitment to advance human welfare, knowledge and understanding, and to explore cultural dynamics (Creswell, 2007; Flick, 2002). Increasingly, the ethical norms of voluntary participation and no harm to participants have become formalised in the concept of "informed consent" (Creswell, 2007; Flick, 2002: 39). Ethical guidelines also serve as standards and as the basis on which all researchers ought to evaluate their conduct (Creswell, 2007: 101). In this study, informed consent to conduct the research was obtained from the necessary authorities. Participants were pre-informed of the objective of the research (cf. consent letter & ethical letter in appendix E).

Researchers interested in 'knowing' through their own institution (s) face the risk and ethical dilemma that affect both their relationship with those the researchers are researching and their final product in terms of text. This interest suggested one thing, reflexivity.

Reflexivity requires an awareness of the researcher's contribution to the construction of meanings throughout the research process, and an

acknowledgment of the impossibility of remaining 'outside of one's subject matter while conducting research. Reflexivity then, urges us to explore the ways in which a researcher's involvement with a particular study influences, acts upon and informs such research.

Accordingly, from the perspective of being an insider, the organisation (University) would surely wish to protect its internal information for corporate reasons. In order to overcome this concern, the researcher became conscious of the natural tendency of such occurrences. Thus, an insider converting into a researcher is clearly more dangerous than a 'true' outsider, because of his/her prior knowledge of the organisational culture. For that very same reason, advocates of change may see such a researcher as a useful political instrument anyway.

The participants were not exposed to intentions and motives that were not directly attached to the research, its methodology and objectives. Confidentiality was respected under all circumstances (Creswell, 2007). All documentation such as policies and procedures, transcriptions and field notes were safeguarded and viewed as strictly private in terms of limits set by the research. A clear demarcation of roles of both the researcher and the participants was clarified during consent.

1.13 OUTLINE OF THE STUDY

The study consists of seven chapters, including this one. Chapter 2 is the first part of the literature review. This is followed by chapter 3, which gives part two of the literature review. The first part focuses on the applicability of IRM and a framework to assess, measure and model institutional-wide risk management in an HEI. The second part details qualities to consider when developing an IRM framework. Chapter 4 outlines the methodology and research approach. It gives the grounds and justification for carrying out the research the way it was conducted. Chapter 5 presents findings/results of the research. Chapter 6 reflects on the data and draws salient issues and meaning from them. Thus, cross validating literature is reviewed. Chapter 7 provides a summary, conclusion and

recommendations of the whole study. The next chapter addresses the literature review.

CHAPTER 2

RISK MANAGEMENT FRAMEWORK AND MEASURES: RELEVANCE IN HIGHER EDUCATION

2.1 INTRODUCTION

The current chapter concentrates on institutional-wide risk management (IRM) framework as applied in this study. The chapter, in so doing, addresses numerous definitions of risk and risk management. The chapter includes sections on risk management in the higher education sector as well as a general view of institutional-wide risk management (IRM) and the characteristics of institutional-wide risk management. A section addresses relevance for institutional-wide risk, its applicability and management in higher education. The chapter concludes with a review of literature on the measures, models and tools that form an IRM framework.

2.2 WHAT IS RISK AND RISK MANAGEMENT?

There are numerous definitions of risk, which are informed principally by the context in which they are applied. Nicholas (2004) notes that there is always a difference in the specific definitions of risk and for that matter measure of risk (cf. ch 5: 90, section 5.3.7: Risk quantification process for details). For many authors (Nicholas, 2004; Turban & Meredith, 1994; HEFCE, 2001) risk means the *uncertainty* of future outcomes (which in the current thesis is termed as downside risk- cf ch 5: 90 section 5.3.8 for details) or *certainty* of future outcomes (which in the current thesis is termed as upside risk (cf. ch 5: 90 section 5.3.8 for details), but for the purpose of this research, while, risk means the probability of an adverse outcome, measures of risk are generated from models that are based on observed statistical/mathematical qualities of risk variables (cf. ch 5: 90, section 5.2-5.3).

Institutions need to adopt a definition that best contextualises risk in their specific environment. Generically, Nicholas (2004) identifies two distinct features

of risk which suggest that risk addresses; (1) the likelihood that some problematical event will occur and (2) the impact of the event if it does occur (cf. ch 5: 90 section 5.2-5.3 for its application). The risk, Nicholas (2004) claims is a joint function of the two (likelihood and impact) risk variables representing the goal contents (variables) of risk management. This mathematically is expressed as:

Risk = f (likelihood, impact)

This mathematical concept of risk is be addressed using educational perspectives **(**Education Funding Council for England-HEFCE, 2001; Stoney, 2007). The HEFCE (2001: 4) defines risk as:

> …the threat or possibility that an action or event will adversely or beneficially affect an organisation's ability to achieve its objectives.

The thought here is to explore the mathematical meaning of risk, due to the effect that risk is directly proportional to its likelihood and impact of occurrence (cf. ch. 5, section 5.3.7 Risk quantification process for details). Suggesting that the management of an institutional objective is a function of its risk, which is a function of the two variables of risk above. HEFCE (2001: 5) notes that risk management is a pr congruent with Stoney's (2007) claim that risk management is the process whereby an organisation methodologically addresses the risks attached to their activities with the goal of achieving sustainable benefit within each activity and across a portfolio of all activities.

Stoney's (2007) assertion is the corner-stone for the institutional-wide approach to management of risk. This is in reference to the above mathematical expression of risk and subsequently its objective institutional-wide. Stoney (2007) affirms that in all cases, the focal point of the concept of risk and risk management links to achieving objectives and also notes that risk management is not just about recognising and mitigating a negative risk, but management of risk should be practised throughout the organisation.

2.2.1 Risk management in the higher education sector

Risk management as a concept is relatively underdeveloped in the higher education sector, as it is in other sectors (King III Report, 2009, Standard & Poor, 2006). In fact, the King III Report (2009), suggests that in many sectors such as manufacturing and finance the need to define risk management and have a comprehensive risk management policy is on the rise, but in many cases of higher education, particularly universities, risk management is seen to be inherent in the way an institution conducts itself, rather than something which needs to be periodically and formally reviewed and described. This comes as no surprise as Bayaga and Flowerday (2010: 2) acknowledge that:

> …risk management emerged in the late 1960s when manufacturing companies started looking for ways to alleviate delivery delays that resulted from large volumes of products and services, the use of risk management however, became popular in the late 1980s and early 1990s….

Additionally, the authors (Bayaga & Flowerday, 2010) assert that the growing use of risk management has drawn the attention of several academic literatures. Bayaga and Flowerday's (2010) view is shared by other authors both in South Africa and in United Kingdom (UK) (cf. King III Report, 2010; Stoney, 2007 for such details) who suggest that an institution's risk management practices should be linked to its strategic framework yet Stoney (2007) laments that it is not always clear that this is the case in current higher education institutions.

This is not to say that a great deal of time and effort should be directed at understanding an institution's risk management variables, which the King III Report (2009:79) identifies as: (1) creating risk awareness in a university (2) risk identification and prioritisation in a university (3) whether the institution alleviates/mitigates risks (4) the reporting and monitoring mechanisms of the risks the institution undertakes (5) the mechanisms of the institution embedding risk management into its planning and operation (6) risk quantification process of various risk factors in the university; without this understanding, university managers may be exposing the institution to unacceptable risk, or to not taking risks where they should. Similar concerns have been

shared by South Africa authors (King III Report, 2007), cross reference ch 5: 90, section 5.2-5.3 for the usage of the risk variables.

A report by Stoney (2007), found that many universities do not have proper risk management procedures and policies. The report suggests that there is wide recognition that risk management should not be about making an institution risk averse. However, some institutions may have moved straight from identifying risk to treating it, without proper consideration of institutional risk management procedures. This approach can ignore the context of the risk and can lead to the implementation of costly, ill-conceived and inadequate 'quick fixes'. Such dangers can be prevented through a proper understanding of institutional risk management procedures and policies.

2.2.1.1 Institutional-wide risk management (IRM)

Several texts and periodicals (Quinn, 2008**;** Power, 2004; Walker et al., 2002; Clarke & Varna, 1999; Miller, 1992) have introduced or discussed concepts such as 'strategic risk management', 'integrated risk management', 'holistic risk management' and 'organisational risk management'. While, Miller (1992) explains that strategic risk management is managing unpredictability of risk in corporate outcomes, the King III Report (2009) suggests that integrated risk management refers to an acknowledgement that risks are not only financial or fraud related but include the ability of a series of planned activities to accomplish relevant political and social objectives. Meanwhile, Stoney (2007) notes that holistic risk management which sometimes is referred to as enterprise or organisational risk management, combines financial, strategic and operational risk in a holistic approach to identifying and mitigating those risks that are the greatest threat.

These concepts are similar to, even synonymous with, institutional-wide risk management (IRM), in that they all emphasise a comprehensive view of risk, quality of an institution and risk management,

a movement away from the silo [5] approach of managing different risks within an organisation separately and distinctly (cf. ch. 1 sections 1.1.1-1.1.3). Thus, some of the variations of IRM, in this case, and for the purpose of this chapter and subsequent ones, IRM and organisational-wide risk management (ORM) will interchangeably be used. Quinn (2008:1) on ORM has adopted the following definition of ORM:

> It is a relatively new (less than a decade old) management discipline that calls for corporations to identify all the risks they face, to decide which risks to manage actively, and then to make that plan of action available to all stakeholders (not simply shareholders) as part of their annual reports.

Several parts of this definition are relevant and merit individual attention.

Firstly, ORM or IRM is a discipline. This means that ORM is an orderly or prescribed conduct or pattern of behaviour for an organisation that has the full support and commitment of the management of the organisation, that it influences corporate decision-making, and that it ultimately becomes part of the culture of that organisation. Secondly, ORM, even as it is defined by **Quinn (2008),** applies to all industries including HEI. Thirdly, the specific mention of exploiting risk as part of the risk management process (along with the stated objective of increasing short-and long-term value) demonstrates that the intention of IRM is to be value creating as well as risk mitigating. Fourthly, all sources of risk are considered, not only hazard risk or those traditionally managed within an organisation. Finally, implicit in this definition is the recognition of IRM as a strategic decision support framework for management. Thus, it improves decision-making at all levels of the organisation in a defined conceptual framework.

2.2.2 Characteristics of Institutional-wide Risk Management

[5] Silos traditionally concentrate on how individual business units operate and perform. Each department within a financial institution is responsible for managing its respective channels (Kleffner et al., 2003).

Organisations have long practised what has come to be called institutional-wide risk management (IRM) or ORM. Literature (Quinn, 2008; Power, 2004; Walker et al., 2002; Miller, 1992) reveals that identifying and prioritising risks, either with foresight or following a disaster, has long been a standard management activity. Walker et al. (2002) note that what has changed, beginning very near the close of the last century is treating the vast variety of risks in a holistic manner and elevating risk management to a senior management responsibility. Walker et al. (2002) maintain that although practices have not progressed uniformally through different industries and different organisations, the general evolution toward IRM (cf. section 1.1.1 Evolution of Institutional Wide Risk Management Framework) can be characterised by a number of driving forces, which this study intends to discuss, the characteristic forces as depicted in literature (Quinn, 2008**;** Power, 2004; Clarke & Varma, 1999; Miller, 1992).

2.2.2.1 A Complex Chain of risk

First, what is a complex chain of risk? In fact, an HEI is particularly complex as it is composed of webs of interlinked chains with shared risks moving within and between any university/college value chains in unexpected ways. For instance, while the latest technology, sharpest design and lowest cost are important, there is another secret weapon that a university may overlook: identification of appropriate human resource. A disruption in the chain can delay service or delivery, which can derail research and teaching/learning. Thus, a university that expertly manages risks in the chain will avoid disruptions altogether and will bounce back quickly from others that are inevitable. This suggests that for a chain strategy to provide a competitive advantage, universities need to understand and manage the complex chain of risk, because, each institution has different risks. However due to integration, certain risks can impact on the whole institution's value chain.

The HEI provides a rich example wherein risk factors in a

university may extend many layers deep down not only in administration but in students throughput rates. This could be through retention of staff to that of students. In such a system with tight webs, risks can impact multiple levels when they trigger. A negative event (downside risk - negative such as risk-below target of retention of staff) can snowball and potentially halt service at the top. For instance, fallout may arise in a university, if it does not map its supply chain and notice the drop-off in teaching and learning materials, by buying extra stocks in advance, suggesting that there may be a need to also arrange preferential agreements with suppliers before crisis mode is reached. If top-level service is halted and service demand is affected, then all levels in the chain are negatively impacted.

From the above argument and that of Power (2004), it can further be said that organisations have come to recognise the importance of managing all risks and their interactions, not just the familiar risks, or the ones that are easy to quantify. Even seemingly insignificant risks on their own have the potential, as they interact with other events and conditions, to cause great damage. Thus, it is imperative for an HEI to note that if they share their risk data and mitigation ideas in a holistic approach, a rich set of mitigation strategies would naturally merge due to the diversity in perspectives and resources. The idea would be to proactively reduce the likelihood of service (teaching, research) stoppages and have plans in place to reduce the impact of identified risks through improved resiliency.

2.2.2.2 External Pressures

The scope and nature of the external pressures in South African universities, and the way in which responsibility is allocated, cannot be separated from the organisational context (King III Report, 2009). Central determinants in a particular context include the way in which a university copes with its external environment and the compatibility of the dominant organisational interests with those of its members. While differences may

arise between the relative importance university managers contextual influences, others may desire that managers' practices predominate over such contextual influences such as trade unions and government legislation (King III Report, 2009; Stoney, 2007).

The influence of external pressures is an impacting force that institutions, regulatory bodies (such as HEQC and Department of Education, Trade Unions) (cf. ch. 1 sections 1.1.1 and ch 2: 19 section 2.2.2 Characteristics of Institutional-wide Risk Management) use through their considerable authority to impose their own preferences on the institutions in question.

Motivated in part by the well-publicised HEFCE (2001) of HEI, national and international regulators (such as in South Africa) and corporate governance (cf. king III report, 2009) oversight bodies have come to insist that institutions' senior management take greater responsibility for managing risks on an organisational-wide scale. IRM is a means for realizing institutional goals and in an ideal world should enable the institution to respond to the demands of its environment by regulating both its internal and external affairs accordingly. In the case of universities, the environment increasingly is differentiated due to posing industry risk. For instance, changes in state funding arrangements, accountability mechanisms, the contribution of the private sector, and the public definition of university education have placed numerous and varied pressures on institutions.

Yet there is a steady reluctance by institutions to accept that their ability to respond to these pressures is equally variable, that they should tailor their ambitions to their capacities, and that their internal/external governance should be adapted using the principle of IRM (King III Report, 2009). From the above and in addition to these codified pressures from such external bodies (HEQC, CHE, HEFCE, International Organisation for Standardisation-ISO), it can be noted that both publicly and privately owned institutions should be well aware of the increasingly vocal desire of their regulatory bodies for stable and predictable progress, which is one of the key objectives of IRM for many organisations.

2.2.2.3 Portfolio of Risk

Van Rensburg (2007) explains that a portfolio risk management point of view or portfolio risk is the founding philosophy for the institutional-wide risk management framework, especially as it is practised in financial markets. Defining it, Van Rensburg (2007: 2) claims that;

> …financial portfolio management is a well-defined and refined discipline which focuses on the overall portfolio performance of combined asset classes and risk profiles in different business cycles.

However, portfolio risk management in general terms is used to select a portfolio of services to maximise the profitability or value of a range of portfolio of risk which may include infrastructure and human resource. This may also include providing balance to support a strategy of an organisation.

Nonetheless, the above financial jargons can easily be translated into HEI. In the case of HEI, the various sections or portfolio of risk of the institution may include academics, infrastructures, students etc, which certainly are sources of risk (cf. ch 5: 90 sections 5.2-5.3 for details). These may be managed collectively because of the web nature as explained in the above definition by the author (Van Rensburg, 2007: 2). This characteristic force, termed as the portfolio point of view has an increasing tendency towards an integrated or holistic view, of risks. An IRM development in higher education, as both HEFCE (2001) and Henkel (2002) note provides a framework for thinking about the collective risk of a group of higher education risk factors and an individual security contribution to that collective risk. Both HEFCE (2001) and Henkel (2002) note a number of principles follow this thinking, including that: (a) the portfolio risk - or risk to the entire organisation, is relevant to the key risk decisions facing that organisation and lastly (b) to understand portfolio risk, one must understand the risks of the individual elements plus their interactions.

Recalling from the above (Van Rensburg, 2007) coupled with other studies (Henkel 2002), suggest that the implications of these principles appears to be having a significant impact on the practice of IRM. There is growing recognition that risks must be managed with the total organisation in mind. To do otherwise (sometimes referred to as managing risk within silos) is inefficient at best, and can be counter-productive. This normally manifests in HEI as separate attention given to separate sections of the institutions involved in IRM. Thus, a holistic and integrated approach helps give organisations a true perspective on the magnitude and importance of different risks.

2.2.2.4 Quantification

This characteristic concerns the technique of converting numbers and text data into unique integers and for storing purposes (cf. ch 5: 90 for such details). This concept is not easy, but promises to provide techniques that can take complexity theory[6] beyond the traditional scientific boundaries and into the related, but wider, areas of the arts and humanities (cf. sections 4.1 & ch. 5 sections 5.1 & 5.2). Translating the above into institutions such as HEI and their regulatory bodies may give a level of confidence in their ability to take actions to operate within established parameters (cf. ch 2: 19 section 2.3, ch 5: 90 section 5.3.1 and ch 6). Arguably, Hausken (2002) writes that despite these advances in quantifying risk, there will always remain risks that are not easily quantifiable. These include risks not well defined, unpredictable as to frequency, amount or location, risks subject to manipulation and human intervention(cf. ch 3: 57), and newer risks (human-made risks, operational and strategic risks are examples of these) (cf. ch. 6 & 7).

In the same way, Clarke and Varma (1999) explain that there has been a continuing effort to better quantify individual risks. This effort is much more difficult, because in addition to individual risks, one must

[6]The study and classification of decision problems by the computational resources –thus the attempt to categorise problems by their fundamental tractability-

quantify or explain interactions between individual risk elements. This can be extremely complex and challenging. However, Hausken (2002) stresses that often there is need for a great deal of precision; even a directionally correct answer may be valuable. The attempt at quantification allows the organisation to analyse “what if” scenarios (cf. ch 5: 90 section 5.3.1). They are able to estimate the magnitude of risk or degree of dependency with other risks sufficiently to make informed decisions (cf. ch 5: 90 section 5.3.1).

As Hausken (2002) further noted, simply going through the quantification process (cf. ch. 5 for details) gives people a better qualitative perspective of the risk. They may gain insight as to the likelihood or severity of the risk or find ways to prevent or mitigate the exposure. As noted from Nicholas (2004) in previous sections (cf sections 1.1.1 Evolution of Institutional Wide Risk Management Framework & 1.1.3 Need for Institutional-wide Risk Management in Quality Management), institutions can manage risk by reducing the likelihood and the consequences of harmful events. To manage this risk, an analyst identifies what constitutes risk.

The various variables under consideration as risk for this case study are (1) target of 3rd stream income (2) pass rates for all students (3) throughput targets met in the institution (4) allocation of infrastructure (5) teaching staff with masters and or doctorates qualification and (6) teaching staff involved in research. Noting from Nicholas’ (2004) assertion that there is no any particular order in the risk elements, literature both of the University under investigation and internationally, revealed that these are the main risk elements impacting on the university (*University of Fort Hare*. http://intranet.ufh/FinalReportForUFH; Liebenberg & Hoyt, 2003; Quinn, 2008**;** Rensburg, 2007:2; HEQC, 2006; Standard & Poor, 2005; Nicholas, 2004; Power, 2004; Clarke & Varma, 1999; Miller, 1992; HEFCE, 2001). The essence of managing and quantifying risk therefore is intended to ensure that every effort is taken to protect and prevent accidents or reducing the risk of them happening and putting in

place management systems to control risks or manage the consequences.

2.3 Relevance for Institutional-wide Risk, its Applicability and Management in an HEI

Institutional-wide risk management (IRM) is the process of planning, organising, leading, and controlling the activities of an organisation /institution in order to minimise the effects of risk in that organisation. In recent years, external factors have fuelled a heightened interest by South African business institutions in the IRM industry and government regulatory bodies, as well as investors, have begun to scrutinise institutions' risk-management policies and procedures (cf. King III Report, 2009). In an increasing number of industries, boards of directors are required to review and report on the adequacy of risk-management processes in the institutions they administer.

The question then is how does this interest affect and apply in an HEI? It is argued (King III Report, 2009) that IRM techniques can be used effectively to establish or modify a range of internal controls that can be used in identifying, monitoring and controlling risk occurrences. The King III Report (2009) suggests that consideration is given to sharing and disseminating good practice and the identification of areas for improvement. It follows therefore that risks are often key elements of the agenda for an HEI.

The King III Report (2009), and Higher Education Quality Committee **-** HEQC (2004) clearly indicate the need to develop accessible, responsive and flexible provision for the management of quality of HEIs and for that matter the risks they face. The benefits may both be in terms of improvements and the creation of opportunities. However, management of risk gives rise to both positive and negative risks, such as risk of occurrence of below target in students pass rates

and/or through put. The clear identification, quantification and management of these risks would enable the institution to gain the planned benefits with minimum risk, by applying risk management techniques (cf. chs 5 section 5.2-5.3 & ch 6 section 6.5 risk and measures of risk), suggesting that risk management is an important dimension of transformational change and quality enhancement. Thus, the use of risk management supports managers in identifying where to put scarce resources and identifying how effectively they are being used to achieve the corporate objectives. The use of risk management techniques in operational activity enables staff to systematically evaluate the choices they are making and be proactive in selecting appropriate interventions where history cannot predict the future.

For example, the use of risk ranking (cf. ch 2: 19 sections 2.4 and ch 5: 90 section 5.3) could be in managing the operational aspects of a research development. Identification of key risk elements such as student achievement levels; achieving student numbers; marketing; quality of teaching and learning; use of public information, can be weighted for probability. This may enable managers to estimate the level of risk they are exposed to and the impact it has on the institution (cf. section 2.2). A manager can then focus on aspects where risk indicators predict there may be either potential opportunities (positive risk) or threats (negative risk) (cf. ch 5: 90 section 5.3 for such details).

2.4 INSTITUTIONAL-WIDE RISK MANAGEMENT (IRM): MEASURES, MODELS AND TOOLS

With reference to the above section (cf. sections 2.1-2.3), which dealt with two frameworks (S&P and institutional philosophy) in literature regarding assessing and identifying risk, it warrants a study of the measures and models used to quantify the identified risks. Literature (Deloitte & Touche, 2006; Walker et al., 2002; McNeil et al., 2005; Slywotzky, Adrian & John, 2005; Nicholas, 2004; DeLoach & James 2000; Bedford & Cooke 2001; Schmidt, 1997) reveals that the first process step in the IRM framework is to establish the context within which the organisation operates.

Critical to establishing this context – and one of the worthy goals of IRM in its own right – is the creation of a common risk vernacular across all functional areas and relevant disciplines throughout the organisation. This section summarises the terminology in common usage among institutions that prastice IRM, forming a large part of the emerging global 'language of IRM'. In so doing, this section introduces and discusses the measures, models as well as tools that help organisations quantify risks.

2.4.1 IRM Measures: Performance Measures across Institutions

IRM clearly links risk management with the creation of organisational value and expresses risk in terms of impact on organisational objectives. An important aspect of IRM, which Slywotzky et al. (2005) explain is the strong linkage between measures of risk and overall organisational performance. Walker et al. (2003) note that the discussion of IRM terminology begins with a description of key institution performance measures using one or more of the (a) S & P and (b) the institution philosophy's frameworks elaborated in sections 2.1-2.3. In addition to establishing context, Epstein et al. (2005) explain that the performance measures have specific application in the identification of risks. Epstein et al. (2005) explained that institutions represent measures as an IRM portfolio in terms of a cumulative probability distribution. The second step is to use it (IRM portfolio) as a base from which to determine the incremental impact of the variables affecting it (IRM portfolio) (cf. ch 5: 90 sections 5.2 -5.3 & 5.3.7 Risk quantification process).

2.4.2 IRM Modelling and Tools

IRM modelling refers to the methods by which the risk and performance measures are determined. This section discusses the major classes of models used in the IRM process. It should be noted that these are general classes of models and tools. The models used within any organisation will typically be customised to accommodate the unique needs of, and the specific risks faced by that organisation.

Epstein et al. (2005) write that most organisations will have at

least a simple model of their operations that describes how various inputs will affect the key performance indicators (KPIs) used to manage the organisation. For any given organisation, these KPIs may be one or more of the overall performance measures. Epstein et al. (2005) maintain that for publicly owned companies, the KPIs are often explicitly or implicitly defined by the market (i.e. they are the measures focused upon by the organisation's chief executive officer (CEO). Because these models explicitly capture the structure of the cause/effect relationships linking inputs to outcomes, they are termed structural (or causal) models .For instance, structural (or causal) models may be used to study the effect of bureaucracy on faculties. This may show that bureaucratic rules may affect the personalities of individual members of an organisation in such a way as to result in an impersonal attitude toward clients or, in the case of the university, students.

Literature (Walker et al., 2003; Epstein et al., 2005; Slywotzky et al., 2005; DeLoach & James, 2000; Deloitte & Touche, 2006; Bedford & Cooke, 2001) reveals that the two general classes of risk models are (a) statistical analytic models (cf. ch 5: 90 for its application) and (b) structural simulation models. In both cases Bedford and Cooke (2001) note that "statistical" and "structural" refer to the manner in which relationships among random variables are represented in a model while "analytic" and "simulation" refer to the way in which the calculations are actually carried out. For the purpose of clarity, these four terms are examined separately below:

Analytic methods – Some authors (Epstein et al., 2005; Nicholas, 2004; Bedford & Cooke, 2001; Turban & Meredith, 1994) note that the models' solutions are determined "in closed form". This means that the models are solved by a set of equations. Bedford and Cooke (2001) note that the methods usually require a restrictive set of assumptions and mathematically tractable assumed probability distributions. The principal advantage over simulation methods is ease and speed of calculation. For instance, a cost function can be estimated for higher education institutions using a panel of data from recent years.

Simulation methods (often called Monte Carlo methods) –

Turban and Meredith, (1994) suggest that these are models that require a large number of computer-generated "trials" approximating an answer. Turban and Meredith (1994) write that these methods are relatively robust and flexible, can accommodate complex relationships (e.g. so-called "path dependent" relationships commonly found in options pricing), and depend less on simplifying assumptions and standardised probability distributions. The principal advantage over analytic methods is the ability to model virtually any real-world situation to a desired degree of precision. For instance any computer/engineering section of a university can use simulation methods to determine the foreseeable behaviour of risk variables (cf. ch. 5). An example is that simulation can be applied in many critical HEI areas. Simulation – in particular process simulation – is a state of the art technology to analyze process behaviour, risks and complex systems with their inherent uncertainties. Simulation provides insights into the designs of development processes and of say, administrative procedures before significant time and cost has been invested, and can be of great benefit in support of training. The creation of virtual laboratories helps to allocate available resources of both industry and academia more effectively.

Statistical methods – as Haimes and Wiley (2004) describe, are models based on observed statistical qualities of random variables without regard to cause/ effect relationships. Bedford and Cooke (2001) acknowledge that the principal advantage over structural models is ease of model parameterisation from available (often public) data. Others as Haimes and Wiley (2004) allude, include mean/variance/covariance[7] (MVC) methods (cf. ch. 5 for details)

Structural methods – Turban and Meredith's (1994) suggestion about structural methods note that these models are based on explicit cause/ effect relationships, not simply statistical relationships such as correlations. The cause/ effect linkages as Turban and Meredith (1994) maintain are typically derived from both data and expert opinion. Bedford and Cooke (2001) note that the principal advantages over statistical

[7] a special class of statistical methods that rely on only three parameters: mean, variance, and covariance matrix.

methods is the ability to examine the causes driving certain outcomes and the ability to directly model the effect of different decisions on the outcome. Turban and Meredith (1994) suggest that these structural models are generally deterministic models, because, they describe expected outcomes from a given set of inputs without regard for the probabilities of outcomes above or below the expected values. Turban and Meredith (1994) maintain that these models can be transformed into stochastic (or probabilistic) models by treating certain inputs as variable. For example, the expected future claim cost from student fees trend might be an input to a deterministic model of institution earnings; recognising that there is uncertainty in this trend, a probability distribution around the expected trend would be an input to a stochastic model.

Table 2.1: *Representation of Relationships of various models (Adapted from: Epstein et al., 2005; Eberlein, Kallsen & Kristen, 2003; Nicholas 2004; Power, 2004; Turban & Meredith, 1994)

Representation of Relationships	Calculation Technique	Relative Advantages
Statistical (based on observed statistical qualities without regard to cause/effect)	Analytic (closed-form formula solutions)	Speed; ease of replication; use of publicly available data (well suited for industry oversight bodies)
Structural (based on specified cause/effect linkages; statistical qualities are outputs, not inputs)	Simulation (solutions derived from repeated "draws" from the distribution)	Flexibility; treatment of complex Relationships; incorporation of decision processes; ability to examine scenario drivers (well suited for individual companies)

***cf chapters 5 section 5.2-5.3 for application and details of the Table.**

The models as the following authors (Liebenberg & Hoyt, 2008; Epstein et al., 2005; Nicholas 2004; Power, 2004; Eberlein, et al., 2003; Hausken, 2002; Kunreuther, 2002; Major, 2002; Turban & Meredith, 1994) describe in Table 2.1 generally presuppose the existence of sufficient data with which to fully parameterise the models. This is often not the case in practice, particularly with respect to operational and strategic risks.

There is a wide variety of risk modeling methods that can be applied to a specific risk. Eberlein et al. (2003) explain that they could be

thought of as lying on a continuum that is based on the extent to which they rely on historical data vs. expert input (cf. Figure 2.3). Along the continuum of sources of information, the methods listed on the left side of the continuum are ones that rely primarily on the availability of historical data. They include, for example, empirical distributions, parametric methods to fit theoretical probability density functions, regression, stochastic differential equations and extreme value theory.

The methods listed on the right of the continuum in Figure 2.2 rely primarily on expert input, including for example, Delphi method and influence diagrams used in Kennedys framework. Studies (Embrechts, Kaufmann & Samorodnitsky, 2004; Eberlein et al., 2003; Bedford & Cooke, 2001; Runggaldier & Zaccaria, 2000) reveal that these methods have been used successfully for several decades by decision and risk analysts to model operational risks in support of management decision-making in manufacturing, particularly in the oil and gas industry, and in the medical sector.

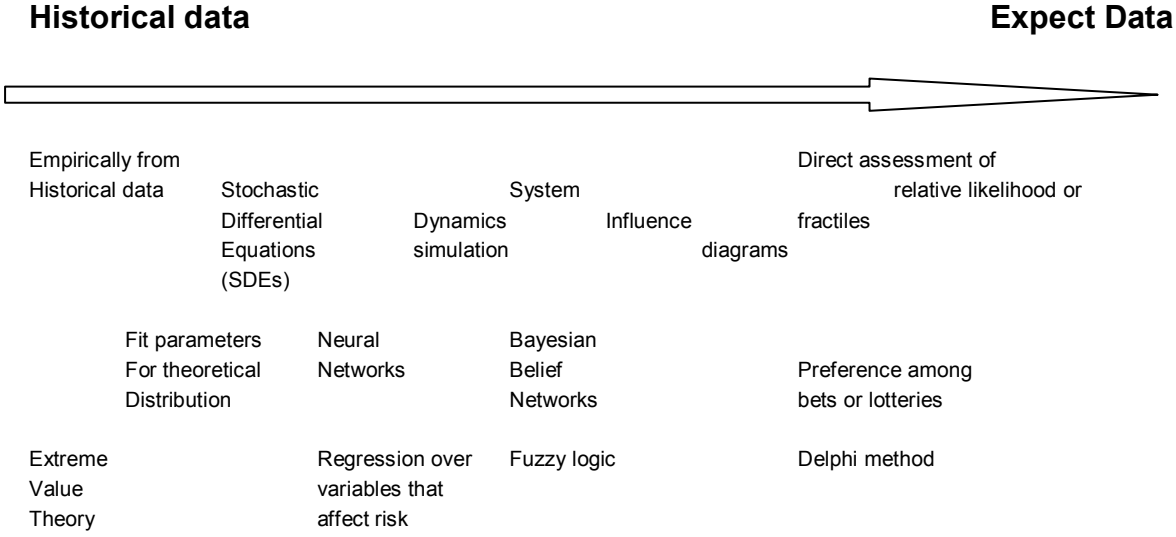

Figure 2.2: Continuum of methods for modelling risks (adapted from: Epstein et al., 2005; Eberlein, et al., 2003; Liebenberg & Hoyt, 2003; Nicholas 2004; Turban & Meredith, 1994; Hausken, 2002)

The methods listed in the middle of the continuum in Figure 2.2 rely on available data and expert judgment to supplement the missing data. In these methods, Embrechts et al. (2004) note that expert judgment is used to

develop the model logic indicating the interactions among key variables and to quantify cause/effect relationships based on experience and ancillary or sparse data. Methods such as system dynamics simulation Bayesian analysis (cf. ch 5: 90 sections 5.2-5.3 & 5.3.7 Risk quantification process for application) and fuzzy logic in particular, are ideally suited for quantifying operational and strategic risks, on the basis of higher degree of subjectivity as opposed to objectivity.

Embrechts et al. (2004) recommend that the choice of method depends significantly on the amount and type of historical data available. The methods also require varying analytical skills and experience. Each method has advantages and disadvantages over other methods, so it is important to match the method to the facts and circumstances of the particular risk type.

For the purpose of this research and further clarification, the research has loosely organised the modeling methods into three categories: (a) methods based primarily on analysis of historical data (b) methods based on a combination of historical data and expert input and (c) methods based primarily on expert input. The discussion is as follows.

2.4.3 Methods Based Primarily on Analysis of Historical Data

These methods are the most appropriate when there is enough historical data to apply standard statistical approaches to develop probability distributions[8] or mathematical approach. Typically, several years of high-frequency data are necessary. Bedford and Cooke (2001) affirmed that these methods are most often used to model risks in a variety of disciplines. Below is a discussion of the methods.

[8] Probability distributions are used both on a theoretical level and a practical level. Some practical uses are (1) calculate confidence intervals for parameters (2) calculate critical regions for hypothesis tests. For univariate data, it is often useful to determine a reasonable distributional model for the data.

- **Empirical Distributions**

The simplest and the most direct approach is to assume that the historical data fully defines a probability distribution (cf. Bayesian analysis in ch 5: 90 section 5.2.7.2.2 Mathematical Model: Bayesian Analysis for its application). Then the data can be used directly to develop a discrete probability distribution. Of course, the danger is in assuming that the data is complete and the time period over which the data is gathered is long enough to have seen or experienced the full range of outcomes. For instance in higher education, it can be used to test a causal model of students' achievement in a course. The variables of the model may include three constructs: abstract analysis, calculus ability, and science experience. Each variable specifies several variates, whose numerical values are measured and intercorrelations computed. The Factorial Modeling (FaM) procedure may be applied to the data to estimate the coefficients of the proposed model's structural equations.

- **Simple Probabilistic Concept**

Embrechts et al. (2002) developed an approach using two important criteria to quantify the risk: (a) the probability, which is the possibility of an undesirable occurrence, and (b) the impact, which are degree of seriousness and the scale of the impact on other activities if any undesirable event occurs. The degree of impact of risk is calculated from the same approach except that it identifies the degree of impact. Using a mathematical description, he described risk as;

R = P * I, where
R = Degree of risk
P = Probability of risk occurring
I = Degree of impact of risk

- **Expected Value (Mean)**

Expected value theory (EVT) is also useful in trying to assess the risks certain courses of action present. Embrechts et al. (2002) explain that most real world choices involve potential losses as well as potential rewards. To assess the risk of a course of action, McNeil (1999) notes that potential losses can be multiplied by the probability of a loss and subtracted from the expected gain. Algebraically, EVT can be given as:

> Risk = (Probability of success * size of reward) - (Probability of failure * size of loss).

The expected value (or mean) of a random variable indicates its average or central value. The expected value of a random variable X is symbolised by E(x) or μ. If X is a discrete random variable with possible values $x_1, x_2, x_3, ..., x_n$ and $p(x_i)$ denotes $P(X = x_i)$, then the expected value of X is defined by:

$$\mu = E(x) = \sum x_i p(x_i)$$

If X is a continuous random variable with probability density function f(x), then the expected value of X is defined by:

$$\mu = E(x) = \int x f(x)\ dx$$

- **Exceedance Probability (EP) Curve**

Kunreuther (2002) included the approach of EP curve, (see Figure 2.3 below). The EP curve is the key element in evaluating a set of risk management tools. EP curves provide information on the degree of uncertainty associated with risk assessment. Kunreuther (2002) explains that EP curves are graphical representations, which suggest an expert knowledge about a particular risk. The accuracy of the EP curve as the author asserts depends upon the ability of the scientific and engineering community as well as social scientists to estimate the impact of events of different probabilities and magnitudes, using different units of analysis.

Estimates must consist of the frequency at which specific events occur and the extent of losses (such as lack of payment of student fees) likely to be incurred. Such estimates can use historic data or scientific analyses of the future. An EP curve specifies the probabilities that a certain level of losses will exceed. The losses can be measured in terms of Rands of damage, failure of students or some other unit of analysis.

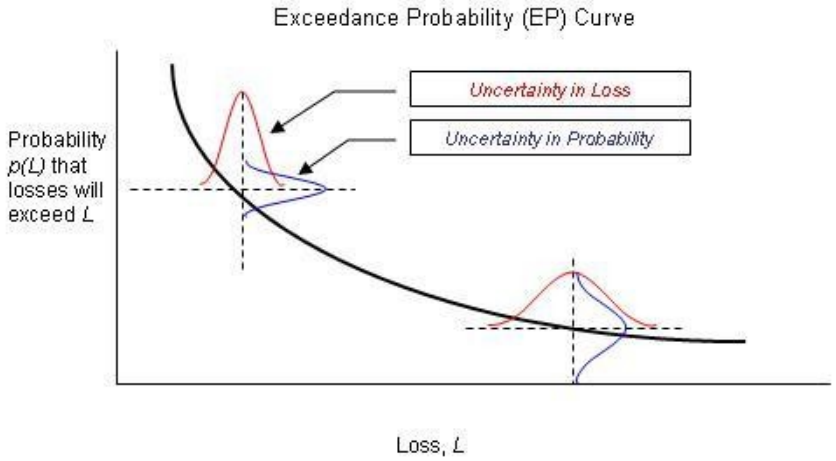

Figure 2.3: Exceedance Probability (EP) Curve

- **Stochastic Differential Equation Model**

Runggaldier and Zaccaria (2000) explained that stochastic differential equation[9] (SDE) expresses two aspects for instance the risk of variables in two different time period; firstly, one gearing towards the difference (or change) in the value of a variable at a certain time (t) and secondly, the value one time period later, (t +1). Runggaldier and Zaccaria (2000) explain that it is a stochastic differential model, because the difference is expressed as a combination of a predictable change and an uncertain or random change during the time period. Runggaldier and Zaccaria (2000) maintain that the random change is represented as a random variable with a specified probability distribution (typically normal distribution).

[9] Starting with an initial value, Runggaldier and Zaccaria (2000) explain that the SDE is used to iteratively determine a scenario of how a value changes over a forecast period (eg. 10 years). For instance hundreds or possibly more scenarios can then be summarised as probability distributions for each point in time over the forecast period.

An illustration of the above is to use techniques from discrete-time stochastic control under partial state information to determine a shortfall-risk minimising risk strategy in the case when there is only restricted information on the type of risk such as in operational and or strategic risks.

- **Extreme Value Theory**

In risk management, Runggaldier and Zaccaria (2000) write that often the most important part of a distribution is the tail representing the downside risk. However, Embrechts (2008) note that most risk modelling methods focus on accurately representing the main body of the distribution. Extreme Value theory (EVT) as McNeil (1999) note is a technique for increasing the accuracy with which to model the probability of large values in the tail distribution. McNeil (1999) writes that EVT is devoted to modelling and estimating the behaviour of rare events. Different EVT models and techniques have been developed and applied to deal with some environmental issues like sea levels, wind speeds and pollution concentrations. McNeil (1999) laments that the main difficulty of estimating rare events is that in most cases there is a small amount of (or even no) data available. For this reason, its application in HEI is non existent (McNeil, 1999). The EVT approach is to develop models based on asymptotic theory (asymptotic distribution is a hypothetical distribution -which is an ordered set of random variables).

Risk management often encounters extreme settings with very few or no occurrences in reality. Inferences about risk indicators in such settings face the problem of insufficient data. Extreme value theory is particularly well suited for handling this type of problem. EVT can be used as a model to establish thresholds for signaling levels of risk in the context of simultaneous monitoring of multiple risk indicators. The proposed threshold system can be well justified in terms of extreme multivariate quantiles, such that its sample estimator is shown to be consistent.

As an illustration, a proposed model in HEIs can be applied to

developing a threshold system for monitoring student performance measures such as pass rates. This threshold system assigns different risk levels to student performance measures. In particular, it divides the sample space into regions with increasing levels of risk. In other cases, such a thresholding technique can be used to determine a suitable cut-off point on a performance measure. This cut-off point or acceptable risk level is chosen to ensure a certain required level of risk in performance.

- **Regression Analysis**

Often it is necessary and useful to develop a model of a variable by examining its drivers or causal variables (cf. ch 5: 90 section 5.3 for application details). McNeil et al. (2005) write that a regression equation expresses this purpose that is a dependent variable as a function of one or more predictor variables. McNeil et al. (2005) maintain that regression equations provide managers write more information on the dynamics underlying a specific risk to help manage, insure or hedge a risk (cf. ch 5: 90 section 5.3 for application details).

In terms of its application in HEI, for instance, a linear regression test of factors influencing student satisfaction with job search assistance can be carried out which may reveal hypothetical significant factors such as whether (a) there exists student's awareness of Career Services programmes in the university and (b) whether students are registered with Career Services programmes or not. A third hypothetical factor could be whether the helpfulness of university staff plays a significant role. From the above, one can identify or test which of the hypothetical factors has a strong influence on factors influencing student's satisfaction with job search using regression analysis. As a second illustration, one could evaluate risk factors associated with students pass rates and quality of infrastructure in a university from a sample of students.

- **Bayes' Theorem (Bayesian Analysis)**

Up to this point, literature has dealt exclusively with what is commonly referred to as classical statistics, where data is readily available for further analysis. In this sub-section, another school of thought in statistical analysis will be introduced, namely Bayesian statistics. The premise of Bayesian analysis within the context of an HEI is to incorporate prior knowledge, along with a given set of current observations, in order to make statistical inferences (cf. ch 5: 90 section 5.2 for details & ch 6 sections 6.3-6.4). The prior information could come from operational or observational data, from previous comparable experiments or from past educational knowledge. This type of analysis can be particularly useful when there is limited test data for a given design or failure mode but there is a strong prior understanding of the failure rate behavior for that design or mode (cf ch. 5 for details of Bayesian analysis-application in HEI).

By incorporating prior information about the parameter(s), a posterior distribution for the parameter(s) can be obtained and inferences on the model parameters and their functions can be made. This sub-section is intended to give a quick and elementary overview of Bayesian methods, focused primarily on the material necessary for understanding the Bayesian analysis[10] methods available. This will be applied in the study in chapter five**.** The essence of the Bayesian approach is to provide a mathematical rule explaining how people in an institution such as an HEI should change their existing beliefs in the light of new evidence. In other words, it allows a risk analyst to combine new data with existing knowledge or expertise.

In symbols
Mathematically, Bayes' theorem states that

$$\text{posterior} = \frac{\text{likelihood prior}}{\text{marginal likelihood}}$$

or, in symbols,

[10] Extensive coverage of the subject can be found in numerous books dealing with Bayesian statistics. E.g. Hoff (2009), A first course in Bayesian statistical methods

$$P(R=r \mid e) = \frac{P(e \mid R=r)\, P(R=r)}{P(e)}$$

where **P(R=r|e)** denotes the probability that random variable **R** has value r given evidence **e**. The denominator is just a normalising constant that ensures the posterior adds up to 1; it can be computed by summing up the numerator over all possible values of **R**, i.e.,

P(e) = P(R=0, e) + P(R=1, e) + ... = sum_r P(e | R=r) P(R=r)
This is called the marginal likelihood (since we marginalize out over R), and gives the prior probability of the evidence.

Example of Bayes' rule

For the purpose of a wide range of applicability of a Bayesian analysis, this study gives its application in two different disciplines (education and medical field). For details of its application in education as noted above see chapter 5 (Bayesian analysis). Here is a simple example, based on the medical field. This is applicable in education as shall be demonstrated in chapter 5 section 5.2.

Suppose you have been tested positive for a disease; what is the probability that you actually have the disease? It depends on the accuracy and sensitivity of the test, and on the background (prior) probability of the disease.

Let P(Test=+ve | Disease=true) = 0.95,

so the false negative rate,

P(Test=-ve | Disease=true), is 5%.

Let P(Test=+ve | Disease=false) = 0.05,

so the false positive rate is also 5%.

Suppose the disease is rare: P(Disease=true) = 0.01 (1%).

Let D denote Disease (R in the above equation) and

T=+ve" denote the positive Test (e in the above equation).

Then

$$P(D=true|T=+ve) = \frac{P(T=+ve|D=true) * P(D=true)}{P(T=+ve|D=true) * P(D=true) + P(T=+ve|D=false) * P(D=false)}$$

$$= \frac{0.95 * 0.01}{0.95*0.01 + 0.05*0.99} = \frac{0.0095}{0.0590} = 0.161$$

So the probability of having the disease given that you tested positive is just 16%. This seems too low, but here is an intuitive argument to support it. Of 100 people, we expect only 1 to have the disease, and that person will probably test positive. But we also expect about 5% of the others (about 5 people in total) to test positive by accident. So of the 6 people who test positive, we only expect 1 of them to actually have the disease; and indeed 1/6 is approximately 0.16. In other words, the reason the number is so small is that you believed that this is a rare disease; the test has made it 16 times more likely you have the disease (p(D=1|T=1)/p(D=1)=0.16/0.01=16), but it is still unlikely in absolute terms. If you want to be "objective", you can set the prior to uniform (i.e. effectively ignore the prior), and then get:

$$P(D=true|T=+ve) = \frac{P(T=+ve|D=true) * P(D=true)}{P(T=+ve)}$$

$$= \frac{0.95 * 0.5}{0.95*0.5 + 0.05*0.5} = \frac{0.475}{0.5} = 0.95$$

This, of course, is just the true positive rate of the test. However, this conclusion relies on your belief that, if you did not conduct the test, half

the people in the world would have the disease, which does not seem reasonable.

A better approach is to use a plausible prior (eg P(D=true)=0.01), but then conduct multiple independent tests; if they all show up positive, then the posterior will increase. For example, if we conduct two (conditionally independent) tests T1, T2 with the same reliability, and they are both positive, we get

$$P(D=true|T1=+ve,T2=+ve) = \frac{P(T1=+ve|D=true) * P(T2=+ve|D=true) * P(D=true)}{P(T1=+ve, T2=+ve)}$$

$$= \frac{0.95 * 0.95 * 0.01}{0.95*0.95*0.01 + 0.05*0.05*0.99} = \frac{0.009}{0.0115} = 0.7826$$

The assumption that the pieces of evidence are conditionally independent is called the naive Bayes assumption. This model has been successfully used for classifying email as spam (D=true) or not (D=false) given the presence of various key words (Ti=+ve if word i is in the text, else Ti=-ve). It is clear that the words are not independent, even conditioned on spam/not-spam, but the model works surprisingly well nonetheless.

- **What is the relationship between graphical models and Bayes' rule?**

For complicated probabilistic models, computing the normalising constant P (e) is computationally intractable (cf. ch 5: 90 mathematical model: Bayesian analysis). This is either because there are an exponential number of (discrete) values of R to sum over, or because the integral over R cannot be solved in closed form (e.g., if R is a high-dimensional vector). Graphical models can help because they represent the joint probability distribution as a product of local terms, which can sometimes be exploited computationally. Baye's nets (directed graphical models) are a natural way to represent many hierarchical Bayesian models.

Example 2

Bayes' Theorem says that:

$$P(Ai \mid B) = \frac{P(B|Ai)\,P(Ai)}{P(B|A1)P(A1) + P(B|A2)P(A2) + \ldots + P(B|An)P(An)}$$

Note that the union of all of the As (A1, A2, ... An) = the total sample space, so they cover every possibility.

There are two bags containing balls of various colours. A bag is selected at random and a ball taken from it at random. The probability of picking a blue ball out of bag 1 is ½ . The probability of picking a blue ball from bag 2 is ¼. If the experiment is carried out and a blue ball is selected, what is the probability that bag 2 was selected? Let A2 be the event that bag 2 was selected and let A1 be the event that bag one was selected. Let B be the event that a blue ball is chosen. Then, using Bayes' Theorem:

$$P(A2|B) = \frac{P(B|A2)P(A2)}{P(B|A1)P(A1) + P(B|A2)P(A2)}.$$

Now, P(B|A2) = probability of picking a blue ball given that bag A2 is selected = ¼ from the question.

Similarly, P(B|A1) = ½ .

P (A1) = probability of selecting bag 1 = ½

= P (A2) Hence P (A2|B)

$= ¼ \times ½$.

½ × ½ + ¼ × ½

= 1/3.

2.4.4 Methods Based on a Combination of Historical Data and Expert Input

Often there is not enough data to reliably quantify risks directly through data analysis. In these cases it is necessary to develop a model of the underlying dynamics (factors) that give rise to the data. See for instance application of Nicholas' model of risk in chapter 5 (cf. section 5.1 & 5.2). This requires drawing on the experience and knowledge of domain experts to fill in the data gaps. The following methods attempt to model the dynamics of a system by using a combination of both historical data and expert input; this is often because there is insignificant data.

- **System Dynamics Simulation**

System Dynamics is a methodology for analysis, problem solving, and simulation development. System dynamic and related methods are robust modelling methods that explicitly simulate the cause/ effect relationships underlying the dynamics of systems. The approach as Turban and Meredith (1994) puts it leverages both existing historical data and the knowledge and experience of senior managers to develop a stochastic simulation model. The model is used to run Monte Carlo simulations and develop probability distributions for the variable of interest. Studies (Turban & Meredith, 1994) reveal that the System Dynamics approach has several advantages over parametric approaches[11] described above, particularly for modelling operational risks.

[11] **Parametric statistics:** A branch of statistical inference which makes assumptions about the underlying mathematical distributional form of observed variables. The most familiar of these

Importantly, Turban and Meredith (1994) explained that it provides a systematic way to fill any gaps in historical data with input from experts relying on their knowledge and experience. This is applicable particularly for modelling operational risks where it is often the case that there is insufficient representative data to apply the statistical methods described above.

Secondly, it provides a way to determine how operational risks change as a function of changes in operations. Since the approach explicitly captures the cause/ effect linkages, it is easier to develop effective ways to mitigate risk and measure their impact than with non-causal methods.

Lastly, Turban and Meredith (1994) note that although many managers of institutions have a good understanding of their own functional areas, but few have a solid grasp of the dynamics of the entire institution. The author maintains that obtaining a complete picture, for example, of the sources of operational risks and how they affect financial performance, requires the combined knowledge of managers across functional areas. The system dynamics approach facilitates this interaction through a structured, participative modelling and decision-making process.

- **Estimating Probabilities through Expert Testimony**

In extreme cases, there are no data at all. In these cases, Houston, Mackulak and Collofello (2001) explain that one must rely on the knowledge and experience of domain experts (cf. ch 5: 90 section 5.1 related to the questionnaire). Probability distributions for events for which there is little or no data can be estimated through expert testimony. To deal with subjectivity in such a case, it is important to assess the validity of the distribution. Nicholas (2004) notes that a naïve method for assessing probabilities is to ask senior management for instance, what is

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hypothetical mathematical distributions is the normal distribution. Binomial and Poisson distributions are also widely used.

the probability that a new competitor will enter the market? However, the expert may have difficulty answering direct questions and the answers may not be reliable. Behavioural scientists[12] have learned from extensive research that the naïve method can produce unreliable results because of heuristics and biases. For example, individuals tend to estimate higher probabilities for events that can be easily recalled or imagined. Individuals also tend to anchor their assessments on some obvious or convenient number resulting in distributions that are too narrow. Decision and risk analysts have developed several methods- see for instance (a) SV, OBT, KSF and KPI.

- **The Delphi Technique**

Delphi technique could be used to explore or expose underlying assumptions or information leading to differing judgments and to synthesise informed judgments on a topic spanning a wide range of disciplines. It is useful for problems that could benefit from subjective judgments on a collective basis.This subsection addressed delphi process. In that regard, it looks at the structure of the Delphi Technique and its policy.

Scientists at the Rand Institute developed the Delphi process[13] in the 1950's for forecasting a future military scenario. Since then it has been used as a generic strategy for developing consensus and making group decisions, and can be used to assess probabilities from a group of individuals. Schmidt (1997) explains that the process structures group communications, usually involving anonymity of responses, feedback to the group as collective views, and the opportunity for any respondent to modify an earlier judgment. The Delphi process involves a

[12] See for instance : Smelser, Baltes, Altmann & Ashenfelter (2001

[13] Delphi technique can be used to explore or expose underlying assumptions or information leading to differing judgments and to synthesise informed judgments on a topic spanning a wide range of disciplines. It is useful for problems that can benefit from subjective judgments on a collective basis.

series of questions to a group; the answers are tabulated and the results are used to form the basis for the next round. Through several iterations, the process synthesises the responses, resulting in a consensus that reflects the participants' combined intuition, experience and expert knowledge.

- **Structure of Delphi Technique**

The heart of a Delphi is the structure that relates to all the contributions made by the individuals in the group and which produces a group view or perspective. In a computer based Delphi, the structure is one that reflects continuous operation and contributions. This is somewhat different to the thesis and pencil mode where the structure must be divided into three or more discrete rounds. As an example, the author describes potential transformations of a simple structure (Policy Delphi) that have often been utilised in thesis Delphis, for use in a computerised environment (Gordon, 1993).

- **The Policy Delphi**

The first example is the Policy Delphi (Gordon, 1993; Linstone & Turoff, 1975). This is an interesting Delphi structure in that the objective is not to produce a consensus, but to expose the strongest pro and con arguments about differing resolutions of a policy issue. It is a form of policy analysis that provides a decision maker with the strongest arguments on each side of the issue. The structure of a Policy Delphi is very simple.

Table 2.4: Policy Delphi structure (adapted from: Turban & Meredith, 1994)

Policy Delphi Structure of increases in staff numbers of HEI		
TYPE OF ITEM	**VOTING SCALES**	**RELATIONSHIPS**
Resolution e.g. increase in number of staff	Desirability/Feasibility: if reasons are good enough then the resolution is voted for other wise voted against.	Alternatives ; substitutes can the be proposed such as using part time academics etc.
Argument; support one's argument for increase in number of staff	Importance Validity	Pro or con to a given resolution Opposing other arguments

In the above structure shown in Table 2.4, any respondent in the Delphi is free to add a possible resolution (solution) to the basic policy issue, or to make a pro or con argument about one or more of the listed possible resolutions. In institutions such as HEIs, the management of an institute could make a resolution about increasing staff members for a particular academic year. He or she can do this at any time. The above leads to management voting at any time on the two types of voting scales associated with either of the item types shown in Table 2.4. Individuals may also choose to change their vote on a given item at any time. In this structure the two scales are needed to highlight situations where policy

resolutions might be rated in such categories as desirable but not feasible, and arguments may be rated as important, but invalid (others might believe it). When making additions of a qualitative nature, participants must also indicate how that addition is related to the existing items.

- **Risk Prioritisation**

Risk prioritisation is ranking material risks on an appropriate scale, such as frequency, severity or both which involves risk mapping (Shankar, 2006). Raz and Michael (2001) describe risk mapping as a visual representation of identified risks in a way that easily allows ranking them. This section which may be dependent on estimating probabilities through expert testimony often takes the form of a two-dimensional grid with frequency (or likelihood of occurrence) on one axis, and severity (or degree of impact-significance) on the other axis; the risks that fall in the high-frequency/ high-severity quadrant are typically given highest priority risk management attention. Raz and Michael (2001) note that the risk map prioritises each risk according to significance and likelihood and maps the risks into four quadrants. Raz and Michael (2001) explain that to map the risks, one puts it into these quadrants:

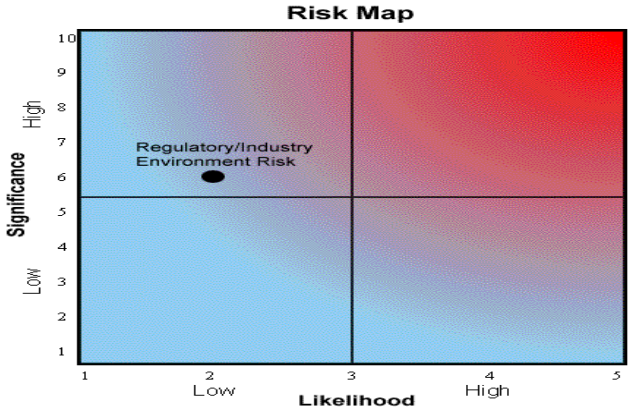


Figure 2.4.1: Risk Map 1 (Adapted from Turban & Meredith, 1994)

1. For each risk, plot the significance on the vertical axis and the likelihood on the horizontal For example, if one rated question 1 of a series of questions; say regulatory and industry risk imposed by say a regulatory body as a significance of 6 and a likelihood of 2 you would plot it as follows on the risk map:

2. Once the top or significant risks are plotted, look at the quadrant where the risks are located. Position in the quadrant helps prioritise the risks and indicates the level of concern and attention, which should be directed toward mitigating that risk given the potential impact on one's institution's ability to accomplish its business strategies.

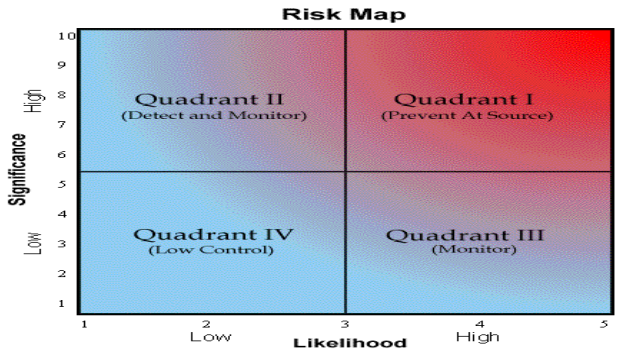


Figure 2.4.2: Risk Map II (Adapted from Turban & Meredith, 1994)

I. **Prevent at Source risks:** Risks in this quadrant are classified as primary risks and are rated "high" priority. They are the critical risks that threaten the achievement of company objectives. These risks are both significant in consequence and likely to occur. They should be reduced or eliminated with preventative controls and should be subject to control evaluation and testing.

II. **Detect and Monitor risks:** Risks in this quadrant are significant, but they are less likely to occur. To ensure that the risks remain low likelihood and are managed by the company appropriately, they need to be monitored on a rotational basis. Detective controls should be put into

place to ensure that these high significance risks will be detected before they occur. These risks are second priority after primary risks.

III. **Monitor risks:** Risks in this quadrant are less significant, but have a higher likelihood of occurring. These risks should be monitored to ensure that they are being appropriately managed and that their significance has not changed due to changing business conditions.

IV. **Low Control risks:** Risks in this quadrant are both unlikely to occur and not significant. They require minimal monitoring and control unless subsequent risk assessments show a substantial change, prompting a move to another risk category. In the example, 'regulatory/industry risk imposed by CHE' falls into Quadrant II, suggesting that this risk should be detected and monitored. Although it is significant, it is unlikely to occur. Detective controls should be implemented and periodic audits used to monitor the effectiveness of controls. The completed risk map should give one a basis for assessing risks and addressing each one in accordance with its potential impact on business strategy.

2.5 CONCLUSION

The essence of the chapter was to elaborate on institutional risk management. The chapter addressed numerous definitions of risk and risk management. It was clear that there was no one definition but rather a contextual one. Another important issue that was considered was risk management in the higher education sector. This led to institutional-wide risk management (IRM) as well as the characteristics of institutional-wide risk management. The next section on the chapter was in the relevance of institutional-wide risk, its applicability and management in higher education. The chapter concluded with a review of literature on the measures, models and tools.

CHAPTER 3

QUALITY OF IRM FRAMEWORK AND MODELS: SUBJECTIVITY AND HUMAN PERFORMANCE

3.1. INTRODUCTION

According to Shankar (2006), quality is the totality of features and characteristics of a product or service that bear on the ability to satisfy specific or implied needs. This definition implies that quality is intrinsic to the product, and represents the *production* view of quality. A second school of thought holds that one must go beyond this definition to attain quality. In this respect, this chapter addresses quality of IRM framework and models. It addresses modeling subjective probability. The last two sections are on human error and human performance as well as measurability of human phenomena.

3.2 Quality of IRM Framework and models

One of the biggest challenges of IRM is quality of models that constitute a framework (cf. ch 1:19 sections 1.1.1-1.1.3) - thus designing and or selecting appropriate models (cf ch 1:19 & 5 section 5.3.1 for more).

In chapter 1 sections 1.1.1 and 1.1.3, it is argued that a model is not the real world but merely a human construct to help better

understand real world systems. In general all models (cf. Section 2.4) have an information input, an information processor, and an output of expected results. It is imperative to note that in this current study there are two main models put together to form the IRM framework. These include (1) mathematical and statistical models, which involve solving relevant equation(s) of a system or characterizing a system based upon its statistical parameters such as mean, mode, variance or regression coefficients (cf. ch 2: 19 section 2.4 institutional-wide risk management: measures, models and tools for such details and ch 5: 90 section 5.2-5.3 for the application of such models). Mathematical models include analytical models and numerical models. Statistical models are useful in helping identify patterns and underlying relationships between data sets (2) Conceptual models are qualitative models that help highlight important connections in real world systems and processes. They are used as a first step in the development of more complex models (cf. ch 2: 19 section 2.4 on system dynamics and related sections). An IRM Framework is still evolving and need to be customised to fit an organisation.

By contrast, other institutions may need a hybrid model, since the risks to be assessed may range from well quantified to those beyond mathematical models. Studies (Embrechts et al., 2004; Raz & Michael, 2001) report that the key principles (aspects) to be considered while creating a model may be grouped into the model attributes and relevance as shown in Table 3.1.

Table 3.1: Attributes of Risk Models (Adapted from: Nicholas, 2004; Turban & Meredith, 1994)

Model Attribute	Relevance
Robustness	Scalability across multiple domains Ability to stand the test of time Consistent
Suitability	Match complexity of operations Address key exposures adequately
Changes needed	Minimum change requirements Easy to implement changes
Cultural fit	Acceptable to people

Institutions such as the manufacturing and the banking industries have over a period of time developed robust modeling techniques for measuring risks using both mathematical/statistical framework and subjective probability theory. However, when it comes to applying it in an HEI, these forms of measurement of risk, especially those of the mathematical/statistical framework need further consideration as chapters 2-3 reveal (cf. ch 2: 19, section 2.4), noting that developing a framework to assess institutional-wide risks continues to be a challenge for institutions. Models can be deterministic (cf. ch 2: 19 section 2.3 & 2.4), i.e. based on a set of specific assumptions about the future, or stochastic to accommodate the random nature of some parameters. Another area of concern to modelers is assessment of the combined impact of risks on multiple dimensions. Aside robustness, Turban and Meredith (1994) note that the framework should be consistent with the test of time- whether it is used in medium term or long term decisions. Noting that there is a degree of both objective and subjectivity probability theories, which to a great extent, influence the modelling process. Since, modelling objective probability is governed by various assumptions and underlying principles, it suffices to elaborate how the research handles biasness in terms of subjective probability principles.

3.2.1 Modeling Subjective Probability

Estimating subjective probabilities is never as straightforward as implied in the description of the methods above (this is further detailed in ch 5: 90 section 5.3.1 & ch 6). Otway and Winterfeldt (1992) write that there are several pitfalls and biases to be aware of. None of the methods work extremely well alone. Otway and Winterfeldt (1992) encourage the usage of multiple techniques. To increase consistency, experts should be asked to assess both the probability of an event and, separately, the probability of the complement of the event. Otway and Winterfeldt (1992) explain that the two should always add up to 1.0 (under probability theory); however,

in practice they seldom do without repeated application of the assessment method. The events must be defined clearly to eliminate ambiguity.

As an illustration, in an HEI and applying human capital theory to subjective probability theory[14], Becker's (1964) analyses show that a student's subjective probability to graduate has a negative influence on the decision to dropout. Human capital theory distinguishes between training in general-usage and institution-specific skills. Becker's (1964) argument suggests that employers will not be willing to invest in general training when labour markets are competitive.

Subjective probability describes an entity's personnel (managers) judgment about how likely a particular event is to occur (also cf. ch 5: 90 section 5.3.1). Nicholas (2004) addresses this as not based on any precise computation, but is often a reasonable assessment by a knowledgeable person. Like all probabilities, in this study a subjective probability is conventionally expressed on a scale from 0 to 1; a rare event having a subjective probability close to 0, a very common event a subjective probability close to 1 (cf. ch 5: 90 & ch 6 section 6.5). Nicholas (2004) explains that the reason for the subjectivity as opposed to objectivity is due to the social setting of some institutions such as an HEI, which does not allow for complete application of empirical probability principles.

3.2.2 Human error and human performance

Another frequently raised challenge to the validity of risk analysis is the difficulty of modeling and predicting human behaviour and the effects of human performance on risk. Spetzler and Holstein (1975) argue that while this issue is sometimes considered synonymous with the problem of human error, it is important to distinguish between human error per se and the effects on managing organisation .

[14] Critics of the theory argue that it is difficult to separate human capital investment from personal consumption.

- **Human error**

Human error has been a causal factor in many large industrial accidents, including those at Three Mile Island, Chernobyl, and Bhopal, as well as others. Hence, it is natural to wonder whether the potential for such errors are adequately incorporated into probability theory in modelling risk. As Glendon, McKenna and Clarke (2006), put it, human errors are conventionally divided into errors of omission (e.g., neglecting to perform one or more steps of a well-defined procedure) and errors of commission (e.g., deliberately undertaking an action not specified in procedures, with undesirable consequences). Glendon et al. (2006), explain that errors of omission are relatively straightforward to model, since such errors can be explicitly enumerated based on a thorough understanding of the procedures to be performed by personnel at any given point in time. On the other hand an error of commission is one where a person responds where they should not. This is compared to an error of omission, where the person fails to respond when they should.

In an HEI, human errors (HEs) may arise from decisions made by academic, management, a human resource unit and top level management. Such decisions may be mistaken, but they need not be. All such strategic decisions have the potential for introducing risk into the institution. These human errors have two kinds of adverse effect: they can translate into error provoking conditions within the local workplace (for example, time pressure, understaffing, inadequate equipment, fatigue, and inexperience) and they can create long lasting holes or weaknesses (untrustworthy alarms and indicators, unworkable procedures, teaching and research deficiencies, etc). Human errors may lie dormant within the institution for many years before they combine with active failures and local triggers to create an accident opportunity.

Jorion (2000) explains that it has been recognised that the majority of errors of commission are rational actions based on the

operators' understanding and perceptions and this falls into a few reasonably well-defined categories. In particular, people are unlikely to undertake actions that do not seem reasonable to them at the time. While these cannot be analysed as easily as errors of omission, the recognition that most errors of commission do in fact have a rational basis makes them more amenable to analysis than was previously thought, and there have by now been several pilot studies incorporating errors of commission into probability theory.

A separate issue, above and beyond being able to identify relevant types of human errors, as Jorion (2000) explains, is the ability to estimate the probabilities of such errors. Here, progress has been relatively slow. In particular, psychologists do not yet know very much about the factors contributing to human error, and risk management practitioners tend to prefer simple mathematical-orientated models for the probability of human error, which may not capture some of the important real world influences on error probabilities, which could be a limitation to risk management and risk measurement.

In light of this, how then can risk be measured, predicted or managed. From the above, the human error problem can be viewed in two ways: the person approach and the system (not devoid of people) approach. Each has its model of error causation and each model gives rise to quite different philosophies of error management – that is the point of IRM- to identify and manage organisational-wide risk. Understanding these differences has important practical implications for coping with the ever present risk.

3.3 Measurability of human phenomena

Accuracy of models was compared from two different perspectives: their completeness and their correctness in identifying high risk factors (cf. ch.

3). Completeness is the percentage of factors that have generated difficult errors actually recognised as such by the model. It tells us how effective the model is in determining the high risk factors, and thus can be used to determine the benefit of applying any remedial actions to these factors. Correctness is the percentage of correct classifications when a factor is classified in the high-risk class using Bayesian analysis (cf. ch. 5). Both measures are necessary to perform a benefit analysis on remedial actions taken on the factors identified as high risk. For instance, given a particular completeness, if correctness is low, the remedial action will be taken on many factors, which are actually not high risk, creating waste of resources and therefore increasing the benefit of the action. On the other hand, if correctness is high, waste of resources will be minimised.

3.3.1 Human reliability analysis (HRA)

The purpose of this section is to provide guidance on how the research performed human reliability analysis (HRA) in the context of an institution. HRA is the study of the interactions between humans (or system operators) and the system in an attempt to predict the impact of such interactions on the system reliability that is the institution (Jorion, 2000). For complex systems such as HEI missions, which involve a large number of human-system interactions (or, simply, human interactions) in almost every phase of the mission, HRA becomes an important element of IRM to ensure a realistic assessment. The HRA analysts, with support from systems analysts, model and quantify these IRMs, which then will be incorporated as human basic events in the IRM models. It should be noted that in addition to 'human interaction (HI),' the terms 'human action,' 'human error,' and 'human failure' have also been used in HRA literature and in this research, particularly, when it comes to the quantification of IRM (Jorion, 2000). Many classifications of IRM or human errors have been proposed in HRA literature (see chapters 2-3, sections). The proposed classifications consider different aspects of HIs such as their

timing with respect to the initiating event (IE), human error type, and cognitive behavior of humans in responding to risk of institutions.

3.4 CONCLUSION

This chapter addressed quality of IRM framework and models that constituted IRM framework. It addressed modeling subjective probability. The last two sections were a synopsis on human error and human performance as well as measurability of human phenomena.

CHAPTER 4
METHODOLOGY AND APPROACH TO RESEARCH

4.1 INTRODUCTION

This chapter covers the methodology and approach to research. It involves a discussion on the orientation of the research, which looks at the positivist paradigm, interpretivist paradigm and mixed methods. The next section covers the research design. This includes addressing the case study design, the case, case selection, sampling within the case and structure of the investigation. The data collection method section then follows. This section addresses instrumentation, questionnaire, interviews, document analysis, triangulation of methods and reliability analysis of instrument. The other three sections address data analysis, challenges of the research and conclude with research rigour.

4.2 ORIENTATION OF THE RESEARCH

This orientation of the research addresses three issues, positivist paradigm, interpretivist paradigm and mixed methods. A research paradigm is a dynamical system of scientific works, including their perceived values by peer scientists, and governed by intrinsic intellectual

values and associated citation endurance and decay (Creswell, 2005). Identifying an emerging research paradigm and monitoring changes in an existing paradigm has been a challenging task due to the scale and complexity involved (Creswell, 2005). A paradigm provides a conceptual framework for seeing and making sense of the social world (Creswell, 2005). To be located in a particular paradigm is to view the world in a particular way. And indeed a paradigm has been termed a world view. The significance of paradigms is that they shape how we perceive the world and are reinforced by those around us, the community of practitioners. Within the research process the beliefs a researcher holds will reflect the way the research is designed, how data is both collected and analysed and how research results are presented. For the researcher, it is important to recognise their paradigm; it allows them to identify their role in the research process, determine the course of any research project and distinguish other perspectives. In this perspective, the current study looks at positivist and interpretivist paradigms.

4.2.1 Positivistic paradigm

One strand of positivism is logical positivism, which represents one particular way of knowing. Writers (Creswell, 2005; Flick, 2002) of this strand assert that researchers gather information through their senses or can discover it through some type of logical derivation or mathematical modeling (cf. ch 2: 19 section 2.4.1 IRM Measures: Performance Measures across Institutions & section 2.4.2 IRM Modelling and Tools). Thus, a crucial premise of positivism is that there are certain regularities in nature, which can be observed and/or discovered. These regularities are called ‘laws’. Laws are universal. Another crucial concept is ‘causality’; people communicate the way they do because some prior condition caused them to respond to a message in certain ways. In such instances, researchers should be able to explain for example IRM factors and their interconnectedness, predict findings and eventually, control the risk of say HEI institutions. Thus, practitioners may follow the argument that findings

could be applied to anyone .This is so, because, laws transcend time and space - noting however, that generalisability only applies in certain conditions.

It is suggested that a positivist paradigm explores social reality based on philosophical ideas of (a) observation (b) measurement and (c) reason - as a means of understanding a phenomenon. Thus, true knowledge is based on experience of senses that can be obtained by observation and experiment. Positivists adopt this scientific method as a means of knowledge generation. Hence, it has to be understood within the framework of the principles and assumptions of science. These assumptions, as past research notes are determinism, empiricism, parsimony, and generality (Flick, 2002). In this research, the researcher follows the positivist view by modelling a mathematical and statistical formula of IRM variables that assist the researcher in determining the composite risk of the institution under study (cf. ch 5: 90 section 5.2-5.3).

In this view, all of reality and for that matter risk is already in a sense pre-determined or pre-existent and, therefore, nothing new can come into existence. As noted above, 'determinism' means that events are caused by other circumstances and hence, understanding such casual links is necessary for prediction and control. 'Empiricism' means a collection of verifiable IRM empirical evidences such as policies, procedures and practices in support of theories or hypotheses.

With these assumptions of science, the ultimate goal of the research is to integrate and systematise findings into a meaningful pattern or framework. The research thus, systematises the generation process with the help of quantification, which is essential to enhance precision in the description of parameters and the discernment of the relationship among them. The examples of methods and approaches are provided in Table 4.1 below.

Although, a positivistic paradigm has continued to influence educational research for a long time since latter half of the twentieth century, it was criticised due to its lack of regard for the subjective states of individuals. It regards human behaviour as passive,

controlled and determined by external environment. Hence, human beings are dehumanised without their knowledge. According to the critics, objectivity needs to be replaced by the subjectivity in the process of scientific inquiry. This gives rise to anti-positivism or interpretive researchers (Snape & Spencer, 2003).

4.2.2 Interpretive researchers

To interpretive researchers, organisational and social realities are constructed as a product of theorising, and this individual theorising itself shapes and affects reality (Snape & Spencer, 2003). Knowledge is thus seen to be comprised of multiple sets of interpretations that are part of the social and cultural context in which it occurs. Interpretive researchers hold, consequently that there should be an openness to the understanding of people being studied in the way that researchers hold or apply their conceptions (Snape & Spencer, 2003).

The array of methods available within quantitative and qualitative views is extensive (cf. Creswell, 2007; Snape & Spencer, 2003). These range from survey and case studies (Snape & Spencer, 2003), action research (Snape &Spencer, 2003), grounded theory (Snape & Spencer, 2003). Indeed, Creswell (2005) offers as many as 20 types of methods. Creswell (2007) offers ethnography, grounded theory, case study and phenomenological studies, while, Yin (2003) also presents various methods for consideration.

Table 4.1: Selection of research approaches and research methods

Research paradigms	Research approach	Research methods	Examples

Positivism	Quantitative	Surveys: longitudinal, cross-sectional, correlational; experimental, and quasi-experimental and ex-post facto research	- Attitude of distance learners towards online based education - Relationship between students' motivation and their academic achievement. - Effect of intelligence on the academic performances of primary school learners
Interpretivism	Qualitative	Biographical; Phenomenological; Ethnographical; case study	- A study of autobiography of a great statesman. - A study of dropout among the female students - A case study of an open distance learning Institution in a country.

From the above, Creswell (2007) explains that a combined-mixed methodology approach facilitates a holistic view and strengthens the internal validity of the design. For this purpose, the study employs a combined-methods design. Creswell (2007) suggests a dominant - less dominant framework for carrying out research using mixed methods; this framework guided the study. Brown and Forcheh (2008: 5) in support of this framework explain that the dominant phase (in this study the quantitative) and also the basics for the current research is built around testing the relationships between factors influencing risk (cf. ch. 5 section 5.2.4 Risk mitigation). The qualitative section is conducted as a follow-up to solicit clarification on the quantitative results as the research questions depicted (cf. ch. 1 section 1.1.6 research questions).

4.2.3 Strengths of Mixed Methods Research

A mixed methods research has a range of strengths. It is particularly useful in survey, evaluation, and field research (Flick, 2002). It has a broader focus than a single method design and gathers more information in different modes about a phenomenon. Yet, the strength of a mixed methods design is that the breadth of findings can bring value to the research process itself by highlighting the particular shortcomings in each of the methods used and compensating for them (Flick, 2002). When the findings are contradictory, they can reveal researcher assumptions that

would not otherwise have been known or the constraints and biases of ways of measuring or interpreting a result (Flick, 2002). However, what makes this design most attractive is its pragmatism, that is, its usefulness in a setting to collect comprehensive information about a phenomenon that can then guide decisions about practice.

All research approaches have their limitations - so too mixed methods. Generally this design takes more time, both at the beginning for pre-planning, negotiation (because of the mix of researcher skills needed) and at the end for coming to agreement as to how the findings fit together (or not) and what they ultimately mean (Flick, 2002). However, its usefulness is such that it may be the best design to answer the questions posed in this research (Flick, 2002).

Deciding how to study the social world has always raised a number of key philosophical debates (Snape & Spencer, 2003: 11). However, this study suggests that while each of these methodologies has substantial value and indeed could arguably stand alone in a research, no one is particularly suitable on its own. What this study offers here therefore is a research approach, which borrows from the full menu of possibilities as and when required. This does mean that commensurability of paradigms is being advocated. Thus, it is important that a mixed-methodology view of the world is proposed.

The ontological stance of this proposed approach to conducting research is firmly rooted in the acceptance of single and multiple realities (Snape & Spencer, 2003). From the epistemological assumption, it recognises the importance of the minimisation of distance between the researcher and interviewees (Snape & Spencer, 2003). It also suggests an axiology, which recognises the value-laden nature of research into micro dimensions. The net result of this is that the researcher advocates the adoption of quantitative and qualitative methodologies which the researcher suggests will lead to enhanced understanding as opposed to the limited understanding offered by a single methodology.

4.3 RESEARCH DESIGN

Having clarified the current study's epistemology, ontological and research questions, the researcher designed a case study research programme, drawing on the strategy of Yin (2003).

4.3.1 Mixed Methods Research

There is some debate over whether or not a mixed methods research is itself a research paradigm or methodology. In the researcher's view, the most commonly used mixed methods designs are simply an approach to research that mixes qualitative and quantitative methods. To understand this, it is helpful to be clear about the difference between methodology and methods, and the terms qualitative and quantitative as aforementioned.

Methodology often refers to a more abstract term than methods and refers to the theoretical assumptions and principles that underpin a particular research approach (Creswell, 2007). It guides how a researcher frames the research question and decides on what process and methods to use. Methods, in contrast, are much more concrete and practical - they are the techniques this research used for collecting and analysing data. The methods a researcher chooses need to fit with the research question.

The terms quantitative and qualitative are commonly used to describe both the methods and the methodologies used in research. Historically, quantitative research has been viewed as synonymous with positivism and qualitative with interpretivism - hence the association with methodology. Some writers consider the terms to refer to two research

paradigms in and of themselves (Creswell, 2005) or, at the other extreme, as terms to merely describe forms of data: quantitative data being numbers and statistics, and qualitative being words and narratives. The researcher argues that the two terms most usefully describe different "types of methods" (Creswell, 2005: 68) that may be used for data collection and analysis. In this sense, the methods are "a-theoretical and a-methodological" (Creswell, 2005: 68) and therefore can be mixed. Thus, the researcher could use the data collection methods of interviewing the participants, measuring results, and observing procedure, depending on the question. To decide sensibly, the researcher would have to identify the research question first; the current study's questions are shown in chapter 1.

4.3.1 Case study design

The researcher used the University's General Prospectus (2009; 34-43) to identify the target population. In the data collection process (cf. ch. 4 section 4.4 data collection), the population included three different types of committees operating in the University. These were; (1) Committees of Senate (2) Joint Council and Senate Committees and (3) Management Committees. The reasons for this selection were threefold. Firstly, the purpose of the research in chapter one notes that the functionality of the research's model lies in a risk analyst's (in this case the committees) ability to predict and model quantifiable risk. Secondly, the various committees assume a position of risk management in the institution and lastly to limit the study to respondents in management as well as decision making positions.

The target population was ninety-one (91) members from the various committees in the University. The data collection phase was taken in two phases. The first phase being the questionnaire administration. This was followed by the second phase (interviews schedules) running concurrently with the former phase. Two-thirds of the questionnaires were sent and received by email, while one-third was sent and received by hand.

With this population size, a simple random sampling was used in identifying various respondents in the committees to answer the questionnaire, while, purposive sampling was used for the interview schedule. Concurrently, the researcher administered the interviews as well. The interviews lasted about 45 minutes. A total of six respondents were interviewed. Members of the University risk (quality) committee, who are primarily members of either an executive management team or a non-executive management team, had access to and agreed to participate in this study. An electronic invitation was sent well in advance to participants.

A few weeks later the questionnaires were sent. The questionnaire process was controlled by anonymity of the respondents. All data used in the study were obtained from the process. The researcher received 64 responses out of 91 respondents, a rate of 70.1 percent. Meanwhile, one of the six respondents purposively sampled was the chief financial officer of the institution. Amongst the other five respondents, one was a manager of the teaching and learning center of the institution. One of the respondents was a director of a school; another directed the quality assurance department of the university. The other two were human resource practitioners of the institution. As part of the research strategy, these respondents were chosen to answer the research questions.

A “research strategy” is the broad plan of how one intends to go about answering the research questions one has asked (Flick, 2002: 39). There are several strategies that one may use when conducting a social science research. The strategy chosen depends on three conditions: (a) the type of research question, (b) the control an investigator has over the actual behavioural events and (c) the focus on contemporary, as opposed historical, events (Yin 2003: 1). In the case of this research, the question mainly focused on the applicability of IRM framework in HEI. Furthermore, the researcher had the choice of using a qualitative and a quantitative or a mixed methodology of research. It was intended to firstly determine the personal experiences of respondents

regarding IRM practices and secondly, most importantly how the business risk management framework operates in the HEI.

Researchers who use quantitative research employ quantitative measures to test hypothetical generalisations (Creswell, 2007), and they also emphasise the measurement and analysis of causal relationships between variables (Creswell, 2007). Since this was one of the researchers' goals – thus wanting to test causal relationships, the researcher used a mathematical model (cf. section 2.4 & 5.2-5.3.8) to compute the risk composite before knowing the *how* and *why* of organisational-wide risk management in HEI by using a qualitative approach. Noting from the above, there are several ways of social science research. Yin (2003: 1) states that case studies

> … are the preferred strategy when how or why questions are being posted, when the investigator has little control over events and when the focus is on a contemporary phenomenon within some real-life context.

Yin (2003: 1) notes that

> the essence of a case of a case study, the central tendency among all types of case study, is that it tries to illuminate a decision or set of decisions: why they were taken, how they were implemented, and with what result.

It was therefore appropriate that the selected strategy for this research was a case study. The questions asked of the institution, the questions asked in the study and the lack of control that the researcher had over the managers' decisions, strengthened this decision.

4.3.2 The case

The case consisted of selected members of committees in the University. Thus the unit of research was the committees of the University (also cf. section 4.3.3. Case selection: Criteria for the Selection of the Institution). These committees supposedly oversee the risk and quality issues of the

institution. They included the various deans, directors and their deputies, faculty managers, faculty risk/quality coordinator, programme coordinators. One may wonder whether the above sample size (64) was sufficient. In this instance, Miles and Huberman (1994: 26) give good advice, noting that a case may be as small as an individual; it may be defined by role, or it may be as large as a nation. Nonetheless, the number of risk analysts in the sample did not pose a problem in this instance, since there seem to be no conclusiveness with regard to the size of the case especially concerning interviews.

Flick (2002) compares a case study research with the work of an artist, suggesting that case-study is the way of the artist, who achieves greatness when, through the portrayal of a single instance locked in time and circumstance, the author communicates enduring truths about the human condition. In essence, the primary defining features of a case study are its multiplicity of perspectives rooted within a specific context (Snape & Spencer, 2003: 52). In the context of this research, then, the multiplicity of perspectives means that each individual role player in the unit may have experienced the use of a risk/quality management system in a different way.

4.3.3 Case selection: Criteria for the Selection of the Institution

There were three underlying criteria required to be fulfilled for an institution to be selected. These criteria which will be explained shortly were important beacuse the ‘case’, which in this study was the university, needed to have come from within an HEI.

First, there would have to be a risk or quality management unit that oversees the institutional risk /quality issues. Second, the case organisation should be certified by the Council for Higher Education (CHE)/HEQC or an appropriate statutory body to undertake degree/higher degree courses. Third, the time from being certified for such course/s should not exceed two years. The reason for the second criterion was that in order to study change processes related to risk/quality implementation,

the case organisation should be relatively 'green'. The first and third criteria were important for obtaining the necessary information related to the implementation and operation process as the questionnaire and interviews depict. On the one hand, study participants should have recent memories of how standards (recommended by HEQC) were implemented and operated. The above criteria delineate the process from cases, which have longer (5-10 years) experiences with CHE/HEQC and have for the period set forth an updated system for risk/quality issues.

4.3.4 Sampling within the case

For this research, the respondents (committee members, also cf. sections 4.3.3 & 4.3.4) at the University of Fort Hare were selected as explained earlier on. Creswell (2007) argues that, "…the accuracy of estimates of population parameters depends on the sample size. For this reason, the general rule of samples is the bigger the better." Since the factors that are normally cited as problems with regard to sample size (such as costs), were not applicable to this study, for the purposes of the questionnaires all members of the population (91) were included, while in the case of the interview it was as stated above. The research primarily was conducted on members of these committees, firstly because, invariably, the unit/committees (these are institutional committees) have the sole responsibility for carrying out the risk/quality management practices for the institution. Secondly, the committee members develop policies, procedures, oversee and enforce practices in all faculty risk/quality issues which pertain to teaching and research which are the core concerns of every university.

The researcher selected this institution from the target population (23 universities) by means of stratified random sampling. The stratification was based on the criteria for selection of the institution as aforementioned (cf. section 4.3.3). Stratified sampling is a commonly used probability method that is superior to random sampling because it reduces sampling error. A stratum is a subject of the population that shares at

least one common characteristic, in this case the risk/quality unit does with all the other faculties in the university. Stratified sampling is often used when one or more of the stratums in the population have a low incidence relative to the other stratums. Creswell (2007) who refers to the "… calculated decision to sample a specific type of interviewee according to a preconceived but reasonable initial set of dimensions which are worked out in advance for a study" was used to select the institution as it represented all the different categories/ dimensions mentioned above.

4.4 DATA COLLECTION METHODS

4.4.1 Instrumentations

Designing a good questionnaire and interview schedule always takes several drafts. In this current study, the researcher concentrated on the content and in addition, looked critically at the formulation and sequencing of the questions. Then the researcher scrutinised the format of the questionnaire. Finally a pilot test (test-run) was conducted to check whether the questionnaire gave the information required and whether interviewers as well as respondents felt at ease with it. The results suggested a satisfactory response (alpha of 0.70) which led to the formulation and sequencing of the questions. The instruments were then adapted based on the pilot study before actual data collection.

4.4.1.1 Questionnaires

The questionnaires were geared towards answering the research questions as stated above. The questionnaire consisted of multiple-choice questions. The first part was aimed at investigating which work setting characteristics (factors) and individual development variables influence risk management- this addresses question 2 as well. The respondents were asked to assess perceived risk in a predefined set of variables some using a five-point scale. The second, third and fourth parts investigated

whether the climate of use of risk management was in line with the current approaches of risk management in an HEI. A question was asked about risk identification, mitigation, reporting, planning (cf. ch. 5 section 5.2 - 5.3).

In order to estimate the risk of the institution, two activities took place concurrently. The first was a series of rated questions asked about the likelihood of an event occurring; this enabled the first part of the composite risk to be estimated. These series of questions involved as pointed out by Nicholas (2004), identifying the likelihood/probability that a risk factor will materialise or occur (see appendix-questionnaire B).

The questions, introduced as recommended by Turban and Meredith (1994), the concept of subjective probability of experienced personnel (manager). Thus from above, the institution's composite risk likelihood factor (ICRLF) was evaluated by assigning likelihood values (subjective probability) or ratings of risk variables in the institution such as students at risk, research funding, staff retention and attraction (cf. ch. 5 section 5.2 results of study for details). This likelihood estimate for interdependent variables of factors was based upon several individual opinions (subjective probability-assuming all have relevant experience). The second activity was also based on a series of rated questions asked about the impact of an event occurring, if it did happen. Thus, what will happen if a risk hazard materialises? Nicholas (2004) notes that the result will be called risk impact. The research use risk impact through qualitative and subjective means as in the case of risk likelihood (cf. appendix-questionnaire B: where 1 - denotes 'rare' and 1- 'almost certain'). Again this activity depended on the opinions of the managers about the impact of the risk. Multiple and dependent risks variables were combined as indicated above in evaluating the risk impact.

The next section looked at how relevant the framework was in the HEI addressing research question five. This also interrogated further questions 2 and 1; what institutional risk management framework is applicable in Higher Education.

To achieve the aforementioned research questions, literature review and interviews were carried out using a guide questions (semi structured). In this instance, research question 2, was interrogated for comparison reasons. Research question 2 for relevance purpose used the interviews followed by a documentary analysis with so as to identify procedures aiding and depicting the relevance of the model.

4.4.1.2 Interviews

The interviews, which were completed, also focused on issues of identification and prioritisation of risks (cf. ch 2: 19 section 2.2.1). This gave a more comprehensive picture of the mission of the institution. The subsequent questions from this interview were directed towards how risk variables were managed (cf. appendix C).

4.4.1.3 Document studies

This approach consisted of a searching-out of underlying themes in the documents being analysed. Coupled with the interviews, this section attempted to address concerns such as how the institution embedded risk management into its planning and operational processes and subsequently, the effects of risk variables set out in chapters 2-3. In this regard, documents such as those governing risk and quality policies and objectives, procedures, instructions and internal/external audit reports were studied (cf. Table 4.2).

Table 4.2: Summary of structure

Aspect investigated	Component of aspect	Method used and sources of data
Research questions 1, 2 and 3	1. applicability of business risk model in HEI 2. relationship of different risk factors/variables	1. Interviewees/sources of data - managers of the risk/quality assurance unit. 2.Sampling- purposive sampling 3. Instrument- interviews and the use of document study 4. analysing using thematisations and document analysis; to explore (I) the institutional processes and procedures underlying risk management and (II) how business model is relevant and can be applied in HEI by comparing the similarities and dissimilarities of phase A and B (Quantitative and Qualitative respectively)

4.4.2 Triangulation

Much has been written about triangulation in research and the need to use multiple methods of data collection in order to reduce the researcher against bias.

> Triangulation in social research is the combination of different methods, methodological perspectives or

> theoretical viewpoints… proponents of triangulated approaches to research assert that the result of combining varied approaches is a net gain – the strengths of each contrasting approach more than cancel the weaknesses of their counterpart. (Flick, 2002: 50).

Flick (2002: 17) advocates the use of triangulation (and thus multiple methods of measuring data) by stating that "…triangulation strengthens a study by combining methods". This may mean using several kinds of methods or data, including using both quantitative and qualitative approaches to research as the current research has done. Triangulation in this research is typically a strategy (test) for improving the validity and reliability of research or evaluation of findings". Flick (2002: 17) used the term structural corroboration – a means through which multiple types of data are related to each other to support or contradict the interpretation and evaluation of a state of affairs.

However, although many researchers support the notion of triangulation and insist on its use, there are several social scientists "…who do not believe that true triangulation is really possible" especially in social science research (Flick, 2002: 100). What we as readers know, we only find out through of the writer, and there cannot be only one truth, or one explanation. There are several overlapping truths and these are constantly changing. Consequently, the term "crystallisation" is a much more useful validating concept than triangulation (Flick, 2002: 17). According to Flick (2002: 17) triangulation is "rigid, fixed, two-dimensional", while crystallisation is three-dimensional. Triangulation assumes that there are three sides (a triangle) to view the world, while a crystal has multiple sides and "… depends upon our angle of repose" (*ibid, 132*). This research uses multiple methods of data collection in order to triangulate, but the crystallisation is dependent on how the reader views the data and each reader creates a different perception of reality, depending on each one's angle.

4.4.3 Reliability Analysis

In order to justify the use of the instrument, reliability analysis was performed. For the risk awareness variables (cf. ch 5: 90), a Cronbach's alpha Coefficient of 0.62 was obtained. For the identification and prioritisation of risks, an alpha value of 0.82 was obtained while 0.63 was attained for risk mitigation /mechanism. Other levels of reliability for the various variables included a 0.82 alpha value for risk management reporting and monitoring, while 0.60 was obtained for embedding risk management into planning and operation variable; lastly an alpha value obtained for risk quantification process was 0.84. Meanwhile, the instrument as a whole had a Cronbach's alpha of 0.72, while with standardised items, the value indicated 0.82. Thus high reliability was achieved for all variables. This fact together with a high Cronbach's alpha as seen in Table 4.3 below means that statistically, a risk analyst will reason that there is a high level of confidence associated with the various variables and the instrument as a whole.

Table 4.3 Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardised Items
0.716	0.821

4.5 DATA ANALYSIS

The data analysis stage addressed both the quantitative and qualitative stages. Quantitative data were analysed using a mathematical model and statistical approach as explained (cf. ch 5: 90, section 5.2). While, qualitative was thematised according to emerging themes.

- **Mathematical and Statistical Data (Quantitative data)**

It is imperative to note that these two activities were guided by the idea of risk consequence. The notion of risk was defined early in chapter 2 as being a function of risk likelihood and risk impact (cf. ch 2: 19, section 2.2). Nicholas (2004) describes this notion as the risk consequence. One approach is to express risk consequence as a simple numerical rating with a value ranging between 0.0 and 1.0 (cf. ch 5: 90- risk likelihood and impact). The risk consequence rating, which is a composite risk, was calculated by using some of the suggested models elaborated in chapters 2 & 3. These included (1) the usage of Bayesian analysis, which is a method based primarily on analysing historical data by using risk consequence (2) the usage of other inferential analysis. This is further elaborated in the data analysis section. The Table 4. 4 summaries the above.

Table 4. 4 Summary of structure II

Aspect investigated	Component of aspect	Method used and sources of data
Research questions 3 and 4	1. predictive estimation by using business risk management model in a HEI	1. Interviewees/sources of data - managers of the risk/quality assurance unit. 2.Sampling- purposive sampling 3. Instrument- questionnaire 4. analysising using mathematical model

- **Categorisation of data**

The researcher used colours to identify the data that belonged to each theme – concepts that referred to the institution were coded in red, those referring to a particular section of the institution were yellow and content related issues were highlighted in green. This tool is called a literal tool where a concrete physical apparatus (in this case, highlighted on the computer) is used (Yin, 2003). The colours thus serve as a coding system and the data is coded accordingly for discussion in chapter 5.

- **Interpretation of the data**

The statements that fall into comparable themes or codes are then examined to see if they have specific meaning in relationship to the purpose of the study (cf. ch. 1, purpose of research).

- **Identification of patterns**

The researcher then reads the data and the statements made by the managers within the context of the categories and look for patterns and topics, which allow the researcher to draw conclusions. The conclusions are discussed in Chapter 6.

- **Synthesis**

The final step in the data analysis and interpretation in the case of qualitative analysis is to provide an overall representation of all the responses and to conclude the study by making recommendations, based on the insight gained into the data risk prioritisation. This will also be discussed in Chapter 6-7.

- **Data capturing and data editing**

All the interviews were recorded on a tape recorder. After each meeting, the researcher captured the data on computer. The open questions were typed according to each interviewee. The closed questions were analysed by computer-statistical analysis - SPSS. The researcher felt that it was imperative to be intimately involved with the data and to be immersed in

the data. A more intimate understanding of what the institution- i.e. the managers think about an issue is obtained, when the researcher is actually present. Creswell (2007: 78) believes that "…most qualitative researchers agree that there is definite value in listening to the tape recordings in addition to reading the transcripts, since the nuances of feeling, tone of voice, pauses and so forth become evident." By doing the data transcripts as the data are collected throughout the period stipulated above, the researcher gains an indication of the foci of the next questions. Reading and listening to the conversations is also the starting point of the data collection process, since the researcher starts immediately with open (unrestricted) coding – the initial type of coding, which allows the researcher to produce provisional concepts (Creswell, 2005).

4.6 CHALLENGES OF THE RESEARCH

There was a number of challenges and remedial solutions encountered in the methodology and the approach to the research. These include (a) presentation and communication of the uncertainties (b) the interpretation of probability theory in a social setting (c) evaluation of models (d) human reliability analysis (HRA) (cf. ch 3: 57 section 3.2.2 Human error and human performance). Here is an account of the challenges and their corrective solutions.

- **The interpretation of probability**

Earlier sections (cf. ch 2: 19, section 2.4 institutional-wide risk management: Measures, models and tools & section 3.2 Quality of IRM Framework and models) have discussed mathematical, statistical and qualitative models. This naturally raises the question of whether these models are different, thus leading to the issue of interpretation of the concept of risk analysis. Under mathematical and statistical, it is a theory that is developed from fundamental principles Bayesian analysis. The theory tells us how to develop new probabilities from given probabilities

with the need for numerical interpretation of final results (cf. ch 2: 19 section 2.4.1 and ch 5: 90 section 5.2-5.3). As discussed, the application of the theory of probability requires that the users should have an interpretation of 'probability' in mind.

The second interpretation is the subjective (cf. ch 3: 57 section 3.2.1 & ch 5: 90 section 5.2). In this research, probability was interpreted as a measure of degree of belief. This is acceptable in probability theory in that it is meaningful to say that one believes that an event is more (equally, less) likely than another event. Probability in this instance is simply a numerical expression of belief. For intance, when it is said that event A has probability 0.6, it means that A is more likely than any other event whose probability is less than 0.6 and it is less likely than any event whose probability is greater than 0.6 (cf. ch 5: 90, section 5.2-5.3). This primitive notion of likelihood, along with several other axioms, allow the development of a rigorous mathematical theory of subjective probability that encompasses the standard mathematical theory on which the research is based.

The issue of which interpretation to accept has been debated in literature and is still resolved, although, in risk assessments, there has not been a single study based solely on relative probabilities. The practical reasons are that (a) the subjective interpretation naturally assigns (epistemic) probability distributions to the parameters of models. (b) the large uncertainties typically encountered in a mathematical and statistical model make such distributions an indispensable part of the analysis. Thus, probabilities in both mathematical and statistical models are fundamentally the same and should be interpreted as inferential and descriptive models should statistics, while the analysis in qualitative be treated as degrees of belief.

4.7 RESEARCH RIGOUR

Just as in every endeavour there is the likelihood of risk involved, in this study, due to the above mentioned challenges, there were a number of

measures taken to minimise the level of risk encountered amongst which included (a) ethical measures (b) measures to ensure trustworthiness and (c) ensuring validity. Below is an account of the details of the measures.

4.7.1 Ethical measures

Creswell (2007) defined "ethical" as "conforming to the standards of conduct of a given profession or group". Equally important, Creswell (2007) refers to ethical measures within research as a set of moral principles which is suggested by an individual or group, subsequently widely accepted, and which offers rules and behavioural expectations about the most correct conduct towards experimental subjects and respondents, employers, sponsors, other researchers, assistants and students.

Research involving human subjects is based on moral commitment to advance human welfare, knowledge and understanding, and to explore cultural dynamics (Creswell, 2007). Increasingly, the ethical norms of voluntary participation and no harm to participants have become formalised in the concept of "informed consent" (Babbie & Mouton, 2002: 522). Ethical guidelines also serve as standards and as the basis on which all researchers ought to evaluate their conduct (Creswell, 2007). Participants were pre-informed of the objective of the research (see appendix- consent letter). Moreover, the basic human rights of the managers as human beings as well as the rights groups and institution were respected. The ethics of justice, fairness, and the code of objectivity were applied during the research.

Research sensitivity, which implies balancing scientific interest (the research) with general values and norms affecting the human dignity needed to be adhered to. Confidentiality was respected under all circumstances (Creswell, 2007). All documentation such as policies and procedures, transcriptions and field notes were safeguarded and viewed as strictly private in terms of limits set by the research. Clear demarcation of roles of researcher and those of the participants were clarified during

consent. Dangers, which needed to be taken into consideration by the researcher were, the danger of objectification and fragmentation and the danger of direct and indirect coercion. Coercion may include the exploitation of vulnerable people taking undue advantage of a participant, volunteer or any other person or the misuse of the authority and influence of the research.

4.7.2 Measures to ensure trustworthiness

The notion of objectivity as it is manifested in particular qualitative research is found in the work of Lincoln and Guba (1985). The key criterion or principle is found in the notion of trustworthiness (Babbie & Mouton, 2002: 276). Since rigour in qualitative research is often questioned, trustworthiness can be established by means of a dense and rich description. (cf. Table 4.5 for an overview of criteria and strategies to ensure trustworthiness) of all aspects of the research investigation. These issues are discussed more fully below.

Table 4.5 Measures to ensure trustworthiness (Adapted from: Babbie & Mouton, 2002)

Criteria	**Strategies to be applied**
	Qualitative research
Truth value	Credibility
Applicability	Transferability
Consistency	Dependability
Neutrality	Confirmability

This study endeavoured to apply the following various strategies to improve rigour and trustworthiness in order to increase the credibility of results and the use of these results to continually improve theory and practice. Sources of rigour identified as effective include: (a) using

multiple methodologies, multiple sources of data, multiple methods of data collection (b) conducting ongoing meta-evaluations and engaging in regular critical reflections on the study and the outcomes of the evaluation- this was made to ensure consistency (c) inviting interviewees to review draft transcripts.

4.7.3 Ensuring validity

In its broadest sense, validity refers to the extent to which the research conclusions are authentic (Creswell, 2007). It is a measure of the extent to which research conclusions effectively represent empirical reality and assessing whether constructs devised by researchers accurately represent or measure categories of human experience (Ivankova, Creswell & Stick, 2006). In this regard the following were considered: (a) to validate the instruments, the researcher consulted the techniques and tools in risk management theory and conducted a pilot study with practitioners (managers). The purpose was to give the researcher an insight into what is theorised as well practised (cf. ch 7 Recommendations. (b) Nicholas (2004) guided the design of my questions. This later concern for validity is what researchers (Creswell, 2007; Ivankova et al., 2006) call construct validity and which means the extent to which a measure of a construct is empirically related to other measures with which it is theoretically associated.

Validity (the accuracy or truthfulness of a measurement) and reliability (the possibility of replicating the study) (Ivankova et al., 2006) are often seen as problematic within qualitative and quantitative research respectively. As is the case with this particular study, the problem stems from the fact that the research material (in this case the managers) is subjective and the questionnaire and interviews are of a once off nature (Creswell, 2007). There is agreement on the impossibility of absolute objectivity (Creswell, 2007). Nevertheless, the researcher is of the opinion that the number of questionnaires handed out, the relatively

large number of respondents, and the fact that the researcher made use of several data collection instruments verify the results.

4.8 CONCLUSION

This chapter covered the methodology and approach to research. It involved a discussion on the orientation of the research, which looked at the positivist paradigm, the interpretivist paradigm and mixed methods. The next section covered the research design. This included addressing the case study design, the case, case selection, sampling within the case and structure of the investigation. The data collection method section then followed. This section addressed instrumentation, questionnaire, interviews, document analysis, triangulation of methods and reliability analysis of instrument. The other three sections addressed were data analysis, challenges of the research and research rigour.

CHAPTER 5

PRESENTATION OF DATA AND ANALYSIS

5.1 INTRODUCTION

This chapter presents the results of the study. During the one and half months of data collection (cf. ch. 4), the process sought to address research questions[15] three and four (cf. chs. 1 section 1.1.6). Meanwhile, literature review (cf. chs. 2-3) addressed all research questions. To serve the purpose of research questions three and four, various variables were investigated both from the questionnaire and the interview schedule as noted in chapter 4. These variables consisted of (1) background information of sample (2) risk awareness in the University (3) risk identification and prioritisation in the university (4) whether the institution alleviates/mitigates risks (5) the reporting and monitor mechanisms of risks the institution undertakes (6) the mechanisms of the institution embeding risk management into its planning and operation (7) risk quantification process of various risk factors in the university[16].

5.2 RESEARCH RESULTS

There were two main methods of data analysis tailored towards addressing research questions two and four. Research question four addressed the predictive power business risk management models have

[15] **RESEARCH QUESTIONS**

- How applicable is a business risk management framework in a higher education institution (HEI)?
- How relevant is risk management framework in an HEI?
- What predictive power do risk management models (that form IRM framework) have within an HEI quality management framework?
- What institutional-wide risk management (IRM) framework is applicable in an HEI quality management?
- What are the implications of IRM for quality management in a higher education institution?

[16] See chapters 2, 3 for details of risk and risk factors.

within an HEI quality management framework. The second interview served as supportive evidence for the statistical indexes. The first part of the data to be presented concerns background information about the respondents.

5.2.1 Characteristics of sample

The first part of the questionnaire addressed background information about the respondents. It consisted of the grade or simply the position in terms of rank in the University's organogram or structure, while, background information sought to confirm the interviewees association with the committees (cf. ch. 4 and questionnaire in appendix C).

Background information is as presented in Table 5.1. The Table revealed that most (35.6%) of the respondents were managers who managed various faculties as well as units in the University. Within the university hierarch 'manager' also includes directors. These managers work closely with student as well as employee related issues. A small percentage (ranging from 14% -1.6%) who responded, was made up of lecturers and junior lecturers. The category of the assistant grade (1-3)[17] employees comprised the bottom rank (cf. questionnaire in appendix c) of employees in the institution, who either were the secretaries of various units and or departments or security personnel. A small percentage (1.6%) consisted of deputy vice chancellor (DVC), registrar, and chief financial officer (CFO) together with chief human resource officer[18] (CHRO). There was an appreciation of the category of professors and directors to 10.9%. Out of the 64 respondents, 23.4% consisted of associate professors and other managers as revealed in Table 5.1.

[17] According to the perommes scale
[18] It is important to note that even at the time of this chapter, the University had no CHRO within that cluster as the position was vacant. But, the human resource manager of the University acted in the capacity of the CHRO.

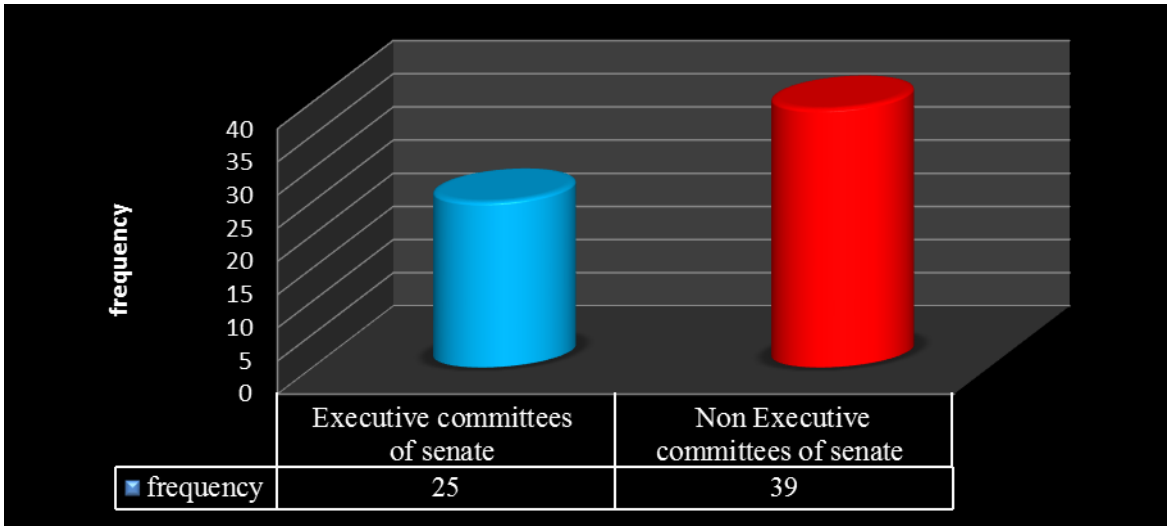
Table 5.1: Distribution of respondents by Committee

	Frequency	Percent (%)
DVC/Registrar/CFO /CHRO	1	1.6
Directors/Professors	6	10.9
Associate Prof. /Managers	15	23.4
Senior Lecturers/Managers 1 /Faculty Managers	23	35.9
Lecturers/	7	10.9
Junior Lecturers/	4	14.1
Assistant Grade 3	1	1.6
Assistance Grade 1	1	1.6
Total	64	100.0

The distribution in Table 5.1 is evidence, which suggests that certain members are less likely (cf. percentage of response of assistance grade 1-3) to report and monitor IRM than others, ultimately affecting the total risks reported and subsequently its management. The researcher used the University's General Prospectus (2009: 34-43) to identify the target sample. The sample consisted of three different types of university committees. These were; (1) committees of senate (2) joint council and senate committees and (3) management committees. These three categories either had members who belonged to the executive committee of senate or non-executive committee of senate. As Figure 5.1.1 below shows, out of the 64 respondents, 25 of them were members of the executive committee of senate, while the other 39 constituted members of non-executive committee of senate. In terms of this composition, although both committees are mandated to conduct risk management on the university, it is important to note that the former takes the final decision on

risk analysis and its awareness as mandated by the University policy (cf. University of Fort Hare http://intranet.ufh/FinalReportForUFH).

Table: 5.1.1: Distribution members in executive and non-executive committees of senate



5.2.2 Risk awareness

In this section, the researcher presents the disaggregated level of risk awareness in the University in terms of various sub-variables. This is followed by the composite risk awareness level in the University. The section is concluded with the main findings of risk awareness in relation to research questions two and four, but first, the section begins with the relevance of variable risk awareness.

What is risk awareness? As noted from some of the authors (Stoney, 2007; Higher Education Funding Council for England-HECFE, 2001) in chapter 2, every institution functions most effectively when each member and unit of the institution is involved in the risk management process. This is especially true in the area of risk awareness.

5.2.2.1 Disaggregated level of risk awareness in the University

Table 5.2 shows distribution of disaggregated level of risk awareness in the University. The Table reveals that the modal response was agreed[19] for two sub-variables. These sub-variables were - the recognition the University has for the need for risk management skills. The findings showed that the University does attach importance to the sub-variable. Although, this was the case, the interview revealed that the University needs to augment its capacity of development in terms of integrated (institutional-wide) risk management skills. This was raised particularly by [20]Lin (cf. appendix B), one of the respondents who noted that:

> …it is important the institution capacitates us as to how to manage risks and quality in our various units, for at the moment, it is assumed we all know how to manage risk.

Lin a committee member (manager) noted that the integrated risk management skills advances employees' focus by strengthening decision-making in the private/public interest and placing more emphasis on consultation and communication. Similarly, integrated risk management skills respect core private/public service values such as honesty, integrity and probity at all levels, and contributes to improved results by managing risk proactively. Integrated risk management as Lin noted also supports a whole-of-University view grounded in rational priority setting and principles of responsible spending.

The comment made above came as a surprise because; the various committee members were mandated to manage risk. But if committee members are not equipped with the technical know-how to

[19] The responses were categorised using a five-point likert scale where: Strongly agree = 5; Agree = 4; Unsure = 3 ; Disagree = 2 ; Strongly disagree = 1

[20] Lin and other names are Pen names (not rela names)

manage risk, then it begs the question of the mandate[21] of the committee members as risk analysts of the university. This point was made much clearer statistically, when respondents [22]strongly disagreed write the sub-variable that the responsibility for risk management was understood and documented throughout the university. In this instance, while the University recognises the need for risk management skills, there were no documentary evidence in terms of policies and procedures of university-wide risk management as revealed in Table 5.2 below. The Table also showed that there was disagreement with regard to the University having a treatment (action) plan.

Table 5.2: Distribution of disaggregate level of risk awareness in the University

		The university has a risk treatment (action) plan	The responsibility for risk management is understood and documented throughout the university	The university recognises the importance of organisational -wide risk management for the achievement of its objectives	The university recognises the need for risk management skills
N	Valid	64	64	64	64
Mode		2	1	4	4
Percentiles	25	4.00	3.00	2.25	3.25
	50	4.00	4.00	4.00	4.00
	75	4.00	4.00	4.00	4.00

5.2.2.2 Composite risk awareness responses

[21] Firstly, the purpose of the research in chapter one noted that the functionality of risk management lies in a risk analyst's ability to predict and model quantifiable risk. This, in this case is the responsibility of the various committees mentioned above. Secondly, the various committees assume a position of risk management in the institution and lastly to limit the study to respondents in management as well as decision making positions.

[22] The responses were categorised using a five-point likert scale where: strongly agree = 5; Agree = 4; Unsure = 3 ; Disagree = 2 ; Strongly disagree = 1

As noted by Standard and Poor (2006), it is important that institutions create reasonable risk awareness in order to respond to the risks of the institution. Table 5.3 shows different degrees of responses. This Table details how many individuals are aware of risks in the University-composite risk. In this study composite risk is a decision-making process used to mitigate risks associated with all hazards that have the potential to adversely affect and impact the vision and mission of the institution.

From Table 5.3, most respondents agreed (59.8%) that they were aware of risk in the University. Although, there were a few who disagreed (14.8%) with the awareness of institutional risk, this combined with the sample who strongly disagreed together with respondents who underscored that they were unsure amounted to 30.1% (1.2 plus 14.8 plus 14.1)

Indeed, with the mandate of the committees in mind, if a risk analyst is guided by the positive picture, this may indicate that overall, there is a good understanding of risk within the University, since, the composite of the agreed and strongly agreed generated an index of 70% (59.8 plus 10.2) where the 30.1% composite of negative response should be a matter of concern, since all committees are mandated to manage risk in the University.

Table 5.3: University risk awareness composite response

Risk Awareness	**Responses**				
	SD	D	U	A	SA
Frequency	3	38	36	153	26
Percent(%)	1.2	14.8	14.1	59.8	10.2

Whereas the indexes in Table 5.3 show a relatively positive side to risk awareness, nonetheless, there is the need to improve risk awareness and increase the University's employee participation. Regarding the above mandate of the committees, Standard and Poor (2005) cautioned that one elementary task for the University's risk managers (in this case the committees) is creating and maximising risk awareness, especially considering that a significant proportion (30.1% - 1.2 plus 14.8 plus 14.1 cf. Table 5.3) was unsure of the University's risk**.** Thus risk awareness should be promoted amongst committee members to enable them to respond, promote and to communicate to the people who are potentially affected.

The above therefore suggests that improving the committee members' understanding and risk awareness and to communicate risk across the institutional risk framework is an important issue for all stakeholders involved in risk measurement. A particular challenge for the University though, is to strengthen employee participation in the establishment of future approaches to risk awareness. The encouragement of employee's participation can be a key element of 'good governance' of the University[23].

From the above data there are two areas of concerns that the University lacks in terms of institutional risk management (1) the University does not address the responsibility of risk management such that it is understood and documented throughout the University (2) there is no University-wide risk treatment (action) plan. On the brighter side though, the data in Table 5.2 also revealed that (1) the University recognises the importance of organisational-wide risk management for the achievement of its objectives and (2) the University recognises the need for risk management skills. This is important because, risk management goes beyond compliance with corporate governance; it makes business sense to implement and embed risk management in the way an organisation does its business. We are living in an era that the only

[23] Governance is here understood as steering and regulating risk management systems, which are represented not only by the University' Management, but integrates concept of risk and risk management into job description.

certainty is change itself. Meeting strategic and operational goals has become very close to the result obtained by throwing a dice. The uncertainty is causing coldness down the spines of investors hence a need to be more 'scientific' in the identification, measurement and mitigation of risks inherent in this ever 'mutating' environment.

5.2.3 Identification and prioritisation of risk

The third variable that was investigated was identification and prioritisation of risks processes in the University. The section follows statistical disaggregation of the sub-variables of identification and prioritisation of risks in the University. A composite response of identification and prioritisation of risks was computed. The section concludes with the main findings of the identification and prioritisation of risks in respect of the disaggregated and composite responses in the University. The objective of risk identification in this study is to identify all possible risks to the University in a timely and proactive manner. Risk Identification methods should have the following attributes:

1. they should examine all areas of the project in a systematic manner,
2. they should be proactive rather than reactive, and
3. they should synthesize risk information from all available sources of risk information.

However, the question is what necessitates the variable identification and prioritisation of risks in a University? The section begins by addressing this question.

In Chapter 2, it was argued that risk management was a process that involved identifying risks. Although, there is no one way of risk identification, some research studies (Standard & Poor, 2006) (1) evaluate the probability[24] of the occurrence of risk and (2) prioritise risk thereby devising methods to reduce/control and respond to the risk.

[24] This may include applying several probability theories e.g. Binomial distribution, expected value theory (cf. ch 2), or evaluating the likelihood and potential impact etc.

Consistent with the two main research questions (cf. section 5.1 introduction) addressed in this chapter, it is further argued that the process of risk identification involves being able to quantify risk. In which case, this quantification seeks to generate some empirical evidence in order to determine the level of impact of risk and to predict the occurrence of risk through some deterministic and or simulated procedures (cf. ch. 2-3). The above line of thought suggests that the empirical evidence generated may then be used in one or many different ways in risk management. These may include to refute an idea and/or support an aspect of argument embodied in the risk management process; once the above is completed, it gives an opportunity to prioritise risk (cf. ch. 2). With the above understanding of risk identification in mind, this research proceeds in two ways (1) by investigating the level of risk identification process in the University (2) investigating the composite response and finally presenting the main findings of this section.

5.2.3.1 Disaggregated level of risk identification and prioritisation in the University

Table 5.4 shows a distribution of various sub-categories that make-up the variable risk identification and prioritisation. The modal response was disagreed (scaled as Disagree = 2). The Table reveals that respondents disagreed that overall, the institution had identified its risks to a sufficient[25] standard. The same was said of the level of sufficiency of risk prioritisation. Another sub-variable which respondents disagreed with was the issue of the institution's key risks being linked to its strategic objectives. There was enough evidence (as evidenced by the responses) to suggest that amongst the sub-variable underlying identification and prioritisation of risk, there was no positive achievement in terms of the

[25] Sufficiency in this study is taken to be 'sufficient' resources to provide comfort and meet obligations. Thus possessing adequate logistical and human accomplishments; of competent power or ability; qualified; fit; capable of meeting obligations and responsibility of the University.

[26]scale of response. This variable was evidently shown to have been insufficiently managed by the University when respondents strongly disagreed that the awareness of the institution's key risks cascaded downward, upward or horizontally throughout the university. This manifested itself when an interviewee (Goba- a director) voiced her concern that:

> …there seem to miscommunication and disjoint in the processes of managing risk. This is because, one never knows exactly when and how risk is conducted in this University. In fact, different faculties have different ways of approaching risks which in a long run duplicates process.

The view shared by Goba resonates with current literature review in chapter 2 and 3 (Standard & Poor, 2005; Nicholas, 2004; Hausken, 2002). Here, the authors' explanation of efficiency addresses the inability to operationalise the institution's business objectives to a sufficient extent.

Table 5.4: Risk identification and prioritisation response of sub-variables

		Overall, the institution has identified its risks to a sufficient standard	Overall, the institution has prioritised its risks to a sufficient standard	The institution's key risks are linked to its strategic objectives	The awareness of the institution's key risks is cascaded downward, upward or horizontally through out the university
N	Valid	64	64	64	64
Mode		2	2	2	1
Percentiles	25	2.25	4.00	3.00	2.00
	50	4.00	4.00	4.00	4.00
	75	4.00	4.00	4.00	4.00

[26] The responses were categorised using a five-point likert scale where: Strongly agree = 5; Agree = 4; Unsure = 3 ; Disagree = 2 ; Strongly disagree = 1

The concerns of the Goba were very much articulated when a respondent (George) (cf appendix D: transcripts) argued that proper risk identification and prioritisation would lead to effective operation of the University in that the process

> …provides a basis for measurement so management can make meaningful decisions and as well to keep track of decisions and their implications so changes over time can be tracked. This seeks to automate, systematize, and enhance analysis so errors and omissions are reduced.

George's view is consistent with my argument that the entire process of risk management provides a basis for measurement. This is of the essence because universities need to measure consequences against some standard of either the industry within which the institution operates or by its own standards. For instance, if a server of the University fails in the data center and nobody notices the crash, has it had a business impact or not? This implies that as a matter of definitive steps, this study then argues that it is a business imperative to answer questions such as (1) is a business impact the rippling effect on other processes the eventual side effects when a second server crashes in the University? or (2) is the business impact the instantaneous unavailability of a service that serves many people? As George notes above, risk identification and the prioritisation process seek to automate, systematise, and enhance analysis so errors and omissions are reduced.

5.2.3.2 Composite risk identification and prioritisation responses

Table 5.5 is a descriptive analysis of the composite responses pertaining to risk identification and prioritisation in the University.

Table 5.5: Risk identification and prioritisation response

		Responses	
		N	Percent (%)
Risk identification and Prioritisation	Strongly disagree	1	0.4%
	Disagree	55	21.5%
	Unsure	43	16.8%
	Agree	135	52.7%
	Strongly agree	22	8.6%

This variable indicated that an encouraging response (52.7%) agreed that the institution does identify and prioritise its risk. From Table 5.5 above, just a few (0.4%) strongly disagreed. But the area of concern was the group of respondents who disagreed as well those who were unsure (38.3%).

The concern is that to manage risks effectively you have to be able to identify potential threats. The risk identification process should not stop short of assessing or analysing risks such that it inhibits the identification of minor risks due to lack of personnel. In effect, every effort should be geared to a process that promotes creative thinking and leverage team experience and knowledge.

The concern could be an issue for the management of the University, which may need to be dealt with. Risk identification and prioritisation is a fundamental issue of risk management. Timely and accurate information is the lifeblood of sound risk management. A good risk-management structure must encompass risks across the entire University, gathering and processing information on an institution-wide

basis in real time. In short, an analyst cannot manage risks if the analyst does not know what the risks are. A comment made by a respondent (Xolani) (cf. Appendix D: transcripts) noted that;

> …effective risk management remains sturdy and durable only if supported by strong and interdependent risk functions that produce unbiased information.

Thus, senior managers should encourage risk managers to be conscientious in uncovering not only risks within each business unit, but also risk concentrations that can arise from a set of activities undertaken by the University as a whole as well as latent risks--such as hidden risk concentrations that can arise from correlation of risk in times of levels of identification and prioritisation. Such risk management analysis should lead risk managers to point out cases in which certain business lines are assuming too much risk.

The above suggests that risk identification is a continuous process. It is wrong to believe that risk identification is a one-off activity which is carried out when the organisation is established and current risks are identified. In today's dynamic economic environment such a point of view is completely wrong. Changes in the environment require continuous attention by risk managers to identification of new risks.

The evidence revealed by the interviewees and the statistical data supports the view that risk practices in the University were not cascaded throughout the institution as seen in section 5.2.3.1 above. In chapter 2, it was argued from Stoney's (2007) view that risk management is a culture, processes and structures that are directed towards the effective management of potential opportunities and adverse effects within a University's environment. A recalling this view, risk is therefore inherent in all academic, administrative and business activities of the University.

From the various data (cf. Table 5.4**)** in this subsection, there are three main areas of concern to the University. These are that (1) the University does not identify and prioritise its risks (2) and that the institution's key risks are not linked to its strategic objectives. To be able

to achieve the above, it was crucial to note that (3) the University does not ensure that the awareness of the institution's key risks is cascaded downward, upward or horizontally throughout the university employees.

5.2.4 Risk mitigation

The fourth variable investigated as noted in chapter two (cf. section 2.2.1-2.2.2) that was risk mitigation mechanisms in the University according to subcategories. The section first disaggregates the variable to ascertain the level of response. This is then followed by a composite response of risks mitigation in the University. A conclusive remark was then made based on the main findings of the risks mitigation in respect of the disaggregated and composite responses to the University. The section starts with the context of risk mitigation used in this research.

Risk identification and prioritisation as noted above are only beneficial if actions are defined and executed to mitigate the risk. Risk mitigation actions must be defined individually for each risk. Stoney (2007) notes that in some cases, immediate actions are necessary. For other risks, future plans and considerations are more appropriate. But, what is risk mitigation? Following research question four, the research defines mitigation as an action that are proactive to prevent a risk from occurring and impacting the University or reducing the impact of the risk. To make this point clearer, if a risk analyst shows that one has unacceptably high levels of risks in the institution, then one needs to take some action to counter them. Thus one could: (1) reduce the probability of the risk affecting the institution (2) limit the impact of the risk if it does occur (cf. Nicholas (2004) definition of risk).

This approach follows Nicholas' (2004) definition of risk (cf. ch 2: 19 section 2.2 what is risk and risk management). In this definition, Nicholas' (2004) points out that risk is a function of the probability (likelihood) and the impact of an event[27] should the event occur. Thus mathematically, there is a direct relationship between risk, its likelihood

[27] In this research event defines risk and or risk factor.

and impact. Hence to control risk, it makes sense to control either its likelihood and/or its impact. This mathematical treatment of the above is modeled here, but will shortly be modeled in a different way in section 5.3.4.2.1 below using both Nicholas (2004) theory of risk and binomial distribution (cf. chs. 2 & 4 as well for further details).

In practice though, the analyst would often wish to do both. However, generally an analyst should try to reduce the probability of the risk affecting the institution in the first place. One way of doing this is risk avoidance**,** i.e. avoiding doing the things that could lead to a problem occurring, such as not entering into a line of business –say recruiting more students even though the University is ill-equipped to accommodate students and staff in lecture theaters. In this instance, it is important to differentiate risk mitigation from risk planning, because as some studies (KPMG, 2008; Standard & Poor, 2005; HEFCE, 2001) cautioned, risk mitigation must not be confused with the planning component of University-wide risk management.

In response to the above definition as described in chapter two (cf. section 2.2) of Nicholas' (2004) view on risk mitigation, attempt was made to investigate the University-wide response to various sub-variables associated with risk mitigation in the University as well as the composite risk mitigation response. This was followed by the mathematical treatment of risk mitigation, which follows theories such as Nicholas' (2004) definition of risk and binomial distribution. This process is again replicated using a different model in a section on quantification of risk as already noted above. The section concludes with the main findings based on the sub-variables and the composite data together with the interviews.

5.2.4.1 Sub-variables associated with the University-wide risk mitigation

Table 5.6.1 reveals responses of each sub-variable regarding risk mitigation. While respondents disagreed with the institution having adequate control mechanisms to mitigate risk, the same could be said of the issue of the institution taking adequate account of the key risks identified by key stakeholders. Thus in both cases, the respondents disagreed with the statements (i.e. 1 - the institution takes adequate account of the key risks identified by key stakeholders and 2- the institution's overall approach to risk management, as assessed for one-academic year is adequate for its strategic objectives). One similar category of such sub-variable was the issue of the institution's overall approach to risk management. In one-academic year, this was not adequate for its strategic objectives. Similarly, respondents disagreed with the statement as evidenced in the modal responses in Table 5.6.1. These categories of sub-variables apparently resonate with the previous variable (cf. Table 5.4), which dealt with risk identification. The question is, in what way do the responses resonate? This, as evidenced in both cases (risk identification and mitigation) suggests that although in a competitive industry such as an HEI environment, every University operates in a climate of risk. It is never possible to remove all risk from a University, but it is important to assess and reduce risk to an acceptable and appreciable level where possible.

In relation to a higher education institution, assessing and minimising risk has recently become very important, particularly meet both international and national requirements. Noting that the term acceptable risk describes the likelihood of an event whose probability of occurrence is small, whose consequences are so slight, or whose benefits (perceived or real) are so great, that individuals or groups in a society are willing to take or be subjected to the risk that the event might occur. The concept of acceptable risk evolved partly from the realisation that absolute safety is

generally an unachievable goal, and that even very low exposures to certain toxic substances may confer some level of risk.

The other sub-variable with which respondents agreed with was the issues arising from audits being brought to the attention of the executive management team. Evidential documents[28] of recent audits revealed that external auditors' reports are prepared and brought to the attention of the management of the University (http://intranet.ufh/FinalReportForUFH)

Table 5.6.1: Sub-variables associated with the University-wide risk mitigation

	The institution has adequate control mechanisms to mitigate risk	Responsibility for the oversight of individual key risks has been assigned to appropriate managers	The institution takes adequate account of the key risks identified by key stakeholders	The institution's overall approach to risk management, as assessed for one-academic year is adequate for its strategic objectives	The issues arising from audits are brought to the attention of the executive management team as appropriate
	64	64	64	64	64
	Mode 2	4	2	2	4
Percentile	25 2.00	2.00	4.00	4.00	3.00
	50 4.00	4.00	4.00	4.00	4.00
	75 4.00	4.00	4.00	4.00	4.00

[28] These documents are not for external circulation, for further references, special permission needs to be sought.

5.2.4.2 Composite associated with the University-wide risk mitigation

A composite risk mitigation response was conducted to respond to the aggregate response of the variable. In this analysis, while well over one-half (60.9%) were in agreement, just a little below one-fifth (17.5%) disagreed with the view that the institution has risk mitigating and mechanisms in place. A comparatively negative response was indicated by 11.9% of the respondents who asserted that they were unsure of the mitigation and mechanisms the institution employs.

Table 5.6.2: University-wide risk mitigation

		Responses	
		N	Percent
Risk Mitigation and Mechanisms	Disagree	56	17.5%
	Unsure	38	11.9%
	Agree	195	60.9%
	Strongly agree	31	9.7%
Total		320	100.0%

With reference to chapter two (cf. section 2.2 what is risk and risk management) and following the above data, Standard and Poor (2005) in chapter 2 , the research reasons that there are inevitably some risks to a University that risk analyst can neither eliminate nor reduce (cf. sub-section 5.3.4.1 below for mitigation analysis) to an acceptable level. For this reason, risk analyst can only mitigate those risks by assessing what might happen as a result of the risk and reducing their impact should they occur. In many situations, the greatest damage can occur because no one fully understands the nature of the risk and ends up making it worse. This as noted by Standard and Poor (2005) occurs when risk is not disaggregated.

Following the above data (Table 5.6.1), the key findings are (1) the University has no adequate[29] control mechanisms to mitigate risk (2) the University does not take adequate account of the key risks

[29] Adequate in this research is being able to meet objects set for a particular time period

identified by key stakeholders and thirdly (3) the university's overall approach to risk management, as assessed for one-academic year is not adequate for its strategic objectives.

Notwithstanding the concerns raised above two positive views are (1) the responsibility for the oversight of individual key risks has been assigned to appropriate managers (2) the issues arising from audits are brought to the attention of the executive management team as appropriate.

5.2.4.2.1 Mathematical treatment of risk mitigation

The essence of this section is to exemplify how to conduct risk mitigation analysis. This is crucial as erroneous decisions could be catastrophic. To begin with, reference is made of Table 5.4. Firstly, the Table reveals various modal responses of the sub-variables at different [30]percentiles. Secondly, and for the purpose of this section, Table 5.4 suggest that while across board the modal response[31] is 'disagreed' as 2 denotes disagreed, the response changes if subjected to variety of quantiles. From Table 5.4, where as 25th percentile corresponds to four different responses, at both the 50th and 75th percentiles, the response remains constant respectively. Thus, in each of the sub-variables, evidenced by Table 5.4 the (respondents) all agreed to each of the sub-variables.

What do the above imply? Judging from the different levels of quantiles, it can be argued that at the 25th percentile, the University does not do well in one or more of the sub-variables in risk identification to ensure appropriate risk mitigation. For instance, with the sub-variable 'the institution's key risks are linked to its strategic objectives'; at 25th percentile there is the probability or chance of respondents not responding to 3, which denotes unsure. And if probability moves up, it does not [32]order well for the University as the committee members supposedly are responsible for decision-making in the University in terms of risk

[30] See the use of percentiles as risk measure in chapter 4
[31] thus the response favoured by the respondents
[32] In this research order denotes 'to speak well"

management. The question therefore is, how does an analyst determine the probability of members responding to say 3, which denotes unsure (or fewer than 3)? To do this, the research uses Binomial distribution (cf. ch. 2).

Firstly, inferring the five-point Likert scale:
The number of responses denoted as n = 5
And 3 which denotes unsure is known

An analyst is required to calculate the probability of responding to three (3) or fewer[33]

ρ (3) ; ρ (2) ; ρ (1) ; ρ (0) ……Equation (1)

Inferring from Table 5.4 and working or benchmarking at the 25th percentile as probability ρ = 25% = 0.25; then according to the equation (2) below, the probability of responding to three being unsure is given as:

$\rho(x=3) = \binom{n}{x} p^x (1-\rho)^{n-x} = \frac{n!}{(n-x)!x!} \rho^x (1-\rho)^{n-x}$……. Equations 2

Substituting ρ =0.25 and x= 3 into Equations 2: we have

$\rho(x=3) = \binom{n}{x} p^x (1-\rho)^{n-x} = \frac{5!}{(5-3)!3!} 0.25^3 (1-0.25)^{5-3}$

$= 10(0.25^3 (1-0.25)^{5-3})$
$=10(0.02) (0.75)^2$
$= 0.1125$

The probability of exactly 3 out of 5 is 11.25 percent: This implies that with the current understanding and knowledge of risk identification process in the University, there is till 11.25% chance of a respondent choosing unsure of the situation in the university. Thus 11.25% will be unsure (p=3) of the University's situation pertaining to the question "the institution's key risks are linked to its strategic objectives" at the 25th percentile.

The other probabilities need to be calculated.

[33] Here fewer denotes 2, 1 and 0 as in the five point likert scale; where 0 is no respondent has an idea of what the University does. Thus question left blank.

$\rho(2) = \rho(x=2) = \binom{n}{x} p^x (1-\rho)^{n-x} = \frac{5!}{(5-2)!2!} 0.25^2 (1-0.25)^{5-2}$

$= 10\ (0.25^2 (1-0.25)^{5-2})$

$=10(0.06)\ (0.75)^3$

$= 0.2531$

Consequently 25.31% will disagreed (p=2) with the University's situation pertaining to the question "the institution's key risks are linked to its strategic objectives" at 25th percentile.

$\rho(1) = \rho(x=1) = \binom{n}{x} p^x (1-\rho)^{n-x} = \frac{5!}{(5-1)!1!} 0.25^1 (1-0.25)^{5-1}$

$=5\ (0.25^1 (1-0.25)^{5-1})$

$=5(0.25)\ (0.75)^4$

$= 0.7910$

Thus 79.101% will strongly disagreed (p=1) with the University's situation pertaining to the question "the institution's key risks are linked to its strategic objectives" at 25th percentile.

$\rho(0) = \rho(x=1) = \binom{n}{x} p^x (1-\rho)^{n-x} = \frac{5!}{(5-0)!0!} 0.25^0 (1-0.25)^{5-0}$

$=1\ (0.25^0 (1-0.25)^{5-0})$

$=1\ (0.75)^5$

$=0.2373$

Thus there is 23.73% chance of risk not even identified by the committee members (p=0) with the University's situation pertaining to the question "the institution's key risks are linked to its strategic objectives" at 25th percentile. Note that this category of members is different from those who strongly disagreed. The category is assumed to have no idea of what is in the University.

What the index implies is that with the current understanding and knowledge of risk identification in the University supposedly known by the members of the committees, there is enough evidence (p=3, p=2, p=1, p=0) to suggest that respondents would choose unsure or fewer than unsure (cf. Table 5.2), if the University benchmarks at the 25th percentile.

The above benchmarking model (cf. ch. 2 section 2.3.5 benchmarking)

as noted by Power (2004), can assist institutions to enhance their risk identification process which subsequently enhances their mitigation approaches. Power's concern is also supported by other authors (Hausken, 2002; Henkel, 2002**;** Barton et al., 2002**;** Clarke & Varma, 1999) who caution the ineffective use of risk identification and quantification process in an organisation.

The mathematical model developed in conjunction with the other sections above (5.3.4 and 5.3.4.1) suggest that risk mitigation can be broken down into two components: (1) risk elimination and (2) risk reduction as revealed in section 5.3.4 (risk mitigation) above. This study argues that a risk elimination process should be an aggressive and proactive risk mitigation for top priority risks. This may follow model (s) as depicted in section 5.3.4.2.1 (Mathematical treatment of risk mitigation) above. This identification and prioritised risks are essential to achieving the full benefits of University-wide risk management. Accordingly risk elimination (which is circumstantial) requires carrying out the necessary action(s) to minimise or remove the identified issue or risks from the University.

On the other hand, a reduction of the degree of occurrence, or lessening of the impact, can be attained by early actions in the University. In the reduction process, even a prototype to confirm say a technology is an example of mitigating the identified risk that the technology is new to the University and may not be able to deliver the required functionality. This mitigation activity would reduce the likelihood of say the technological environment causing a problem to the University in service as it would have been previously tested or proven.

However, this study cautions that universities need to beware of the 'risk' of 'risk mitigation', because, sometimes they may not go far enough. In the example above, the mitigation may concentrate resources to address the prototype and then assume that there would be no problems with the service implementation. This would reduce the likely occurrence but not eliminate it completely.

5.2.5 Risk management reporting and monitoring

Following Nicholas's view of risk monitoring in chapter two, section 2, the other variable under investigation was risk reporting and monitoring in the University. The section first disaggregated the variable by responding to various sub-categories. This was then followed by a composite response of risk reporting and monitoring in the University. A conclusive remark was then made based on the main findings of the risk reporting and monitoring in the University in respect of disaggregate and composite responses to the University. But first what is risk reporting and monitoring?

Nicholas (2004) in chapter two section 2 explains that each risk that requires mitigation or a contingency plan to be prepared should be assigned to a member of the University team to monitor. The risk monitor should be responsible to the University- wide risk manager/audit section for monitoring the risk, reporting any change in condition and taking the agreed contingency action (plan) if the risk occurs. Inferring from Nicholas' (2004) view and from section 5.3.4 (Risk mitigation) above, monitoring of University-wide risks in this study can be achieved by using the following actions:

- include risk mitigation tasks in the University schedule
- define appropriate risk milestones
- review risk tasks regularly in University-wide risk management meetings
- perform inspections on risk status

Risk monitoring forms an essential part of completing a University-wide risk management process. Recall that in chapter two section 3.3, it was discussed that some risks can be eliminated, but some new risks may emerge or occur. Some mitigation actions would work well but, some may not and thus need to be revised and alternate actions would need to be taken.

If the University continues with its risk management process, risk priorities may also change and new risk planning would be required, suggesting the need to monitor and report risk on a continuous basis using a schedule. The University risk schedule in this instance is an

ideal tool to monitor risks. A risk matrix shows the controls within any application system used to reduce the identified risk**.**

5.2.5.1 Sub-variables associated with the University-wide risk reporting and monitoring

In this category of risk reporting and monitoring, there were five sub-variables as evidenced in Table 5.7 below. The distribution of the Table was reported in their modal responses. This distribution in Table 5.7 revealed that the modal response was in each case disagreed (suggesting that respondents do not agree that there is University-wide risk reporting and monitoring) with each sub-variable. The only sub-category which respondents agreed to was that external auditors conduct audits as part of statutory regulation. This could be as a result of external pressures from government as discussed in chapter 2 (cf. ch. 2 section 2.2 for details). Indeed a reference to section 5.3.4 also supports the view of external auditing taking place.

Table 5.7: Disaggregated of University-wide risk reporting and monitoring

		Overall reporting processes give designated officers sufficient information on risk to make required annual audit	Formal risk management monitoring and reporting arrangements have been put in place for the executive management team/audit committee	The university applies sufficient resources to risk management and its development	There are early warning indicators for all the key risks reported to management within regular management information reports	External auditors conduct audits as part of statutory regulation
N	Valid	64	64	64	64	64
Mode		2	2	2	2	4
Percentiles	25	2.00	2.00	2.00	4.00	4.00
	50	4.00	4.00	4.00	4.00	4.00
	75	4.00	4.00	4.00	4.00	4.00

The concern was that there were no formal risk management monitoring and reporting arrangements in place for the executive management team/audit committee. Another area of concern which interviewees noted was that the university did not apply sufficient resources to risk management and its development. The other form of analysis carried out was the combined response of the risk reporting and monitoring.

5.2.5.2 Composite risk associated with University-wide risk reporting and monitoring.

In chapter three section 3.3, Nicholas (2004) noted that modeling IRM processes provide a disciplined and documented approach to risk management for proactive decision-making, which in this case is similar to a risk monitoring process. In response to the above, the research investigated how the University fares with risk monitoring and reporting. Referring to Table 5.8, even though, nearly two-thirds (68.1%) agreed that the institution conducts risk reporting and monitoring, a number of respondents (20.0%) disagreed , while 7.8% were not sure of the situation in the institution.

Table 5.8: University-wide risk monitoring and reporting

		Responses	
		N	Percent %)
Risk reporting and Monitoring	Disagree	64	20.0%
	Unsure	25	7.8%
	Agree	218	68.1%
	Strongly agree	13	4.1%
Total		320	100.0%

With reference to the disaggregated data above, an analyst may reason that the University undertakes audits to the extent the index (external audit sub-variable) reveals in Table 5.7 above. The above index suggest

that the practice of risk reporting does occur in the University, but what the indexes do not reveal is sufficient empirical evidence as to how the University undertakes risk monitoring and reporting. To interrogate how the University does this, the research turns to the interview sessions.

During the interviews, one respondent noted that there was a lack of efficient risk management processes and policies in the University's procedures. This as Lin remarked was:

> …..there are undefined structures in place, besides, both theoretically and practical implementations are problems, because of lack of clear policies, procedures and resources of University risk management.

The audit committee members report directly to EMT (see background information) for further corrective measures to be taken if applicable. The other aspect is the various committees in place at the university (University of Fort Hare. http://intranet.ufh/FinalReportForUFH) .

These committees are assigned the duty to quality assure the processes within various units. Lin explained that with regards to teaching, there is the central academic planning committee which is responsible for the approval of new programmes offered at the university and it has to make sure that there are correct resources available. It also deals with teaching and learning (TLC), whether there are sufficient resources to support students and staff in delivering a programme. Further it also includes the financials; this deals with how

Committees affect the institution financially, whether they drain the institution or not. The responsibility of the committee also extends to addressing issues around human resources as to whether the university has the human capacity to teach and support the programmes. There are also other structures that deal with the executive committee of senate (Senex) that looks at teaching assessment. In most cases, senex looks at the advancing of degrees. More so, interviewees noted the need to monitor physical risk as Standard and Poor (2005) stresses. In this direction, the University in 2008 appointed a practitioner a safety, health

and environment officer (SHEO) to ensure that the quality of the buildings is safe for conducive occupation and use.

Needless to say, compared to Nicholas' (2004) view as aforementioned as in chapter 2, it is imperative to note that there were still great strides to be made in the form of University-wide risk management policies and procedures, stressed by a respondent. Moreover, there was no documentary[34] evidence (both hard evidence and on intranet) readily available in the form of policies and procedures in relation to institutional-wide risk management, suggesting that regardless of Lin's explanation of the university monitoring and reporting, there is still more to be addressed with reference to this concern. This may be challenged and debated as the university has a range of policies and procedures posted on its intranet. Cross examination of these policy and procedures revealed that they were all admission and labour relations documents. None of the documents relates to any university-wide risk policy and procedure.

Thus, in view of the disaggregated data (cf. Table 5.7) and composite data, the researcher concludes there are (1) no University overall reporting processes designated to risk officers (managers) (2) no formal risk management monitoring and reporting systems (3) no sufficient resources in relation to risk management and its development in the University.

5.2.6 Risk management planning and operation

In chapter three section 3.3 (cf. Table 3.3; ch. 3), some studies (Epstein, et al., 2005; Slywotzky et al., 2005; DeLoach & James, 2000) show that the risk management process continues with risk analysis, planning, tracking and control. The additional variable under investigation is risk planning and operation in the university. The section first disaggregates the variable by responding to various sub-categories as the preceding

[34] See for instance *University of Fort Hare*. http://intranet.ufh/FinalReportForUFH . University of Fort Hare Final Strategic Risk Assessment, (2009). It is VERY IMPORTANT to not that these sites together with the documents need special permission to be assessed.

variables. This is then followed by a composite response of embedding risk planning and operation in the University. But first what is embedding risk planning and operation?

All risks need to have contingency plans prepared. For this reason, risk planning involves defining action steps to be carried out when risk is identified. A plan of action should be prepared for each risk especially high priority risk cannot be proactively eliminated. This action plan would enable the University to recover from or survive a risk occurrence. Recalling from literature (Standard & Poor, 2005, KPMG, 2008, Nicholas, 2004) in chapter 2, addressing a risk occurrence by carrying out of a contingency plan is unlikely to completely eliminate risk entirely? Thus a risk that has been dealt with by the carrying out a plan may still represent a significant University-wide risk. In this view, the disaggregated component is explained.

5.2.6.1 Disaggregated risk planning and operation in the University

An investigation was conducted to find out what sub-variables were addressed under University-wide risk planning. The Table 5.9 below showed various sub-variables under consideration. Generally speaking, the University's modal response for the sub-variables (cf. Table 5.9) was that the respondents agreed with the various sub-categories. This meant that across the University, the Figures suggest that there is risk planning. Contrary to this general risk response is the question of 'institutional policy documents adequately dealing with risk management issues'. The evidence in Table 5.9 below suggests institutional policy documents do not adequately deal with risk management issues. This came as no surprise as the interviewees in section 5.3.5 rightly acknowledged this challenge.

Table 5.9: University response to risk planning sub-variables

		Overall, the institution embedded risk management into its planning and operational processes extent	There are mitigating controls for the key risks which are fully embedded into the institution's business processes	The institutional policy documents adequately deal with risk management issues	Internal auditors conduct audits as part of statutory regulation	The institution has considered both financial and non-financial risks(e.g., reputation, fraud, health and safety, business continuity) in its strategic objectives
N		64	64	64	64	64
Mode		4	4	2	4	4
Percentiles	25	4.00	2.25	4.00	4.00	2.00
	50	4.00	4.00	4.00	4.00	4.00
	75	4.00	4.00	4.00	4.00	4.00

5.2.6.2 Composite risk planning and operation in the University

In response to the above, the discussion that follows investigates the level of response of the University's risk planning and operations. Amongst the responses, the favoured response was two-thirds (71.6%) who agreed that the university does undertake risk planning. This was encouraging. The responses who either disagreed and or were unsure of the situation of the university amounted to nearly one-fourth (26.5%) as seen in Table 5.10 below.

Table 5.10: University risk planning and operation

		Responses	
		N	Percent
Risk planning and operation	Disagree	59	18.4%
	Unsure	26	8.1%
	Agree	229	71.6%
	Strongly agree	6	1.9%
Total		320	100.0%

It is noted that risk planning involves the thoughtful development, implementation, and monitoring of appropriate risk response strategies. In this study (cf. chapter 2) risk planning was defined as the detailed formulation of a plan of action for management of risk. It suggests that risk planning is the process to do the following:

- Develop and document an organised, comprehensive, and interactive risk management strategy.
- Determine the methods to be used to execute a risk management strategy.
- Plan for adequate resources.

Risk planning therefore is iterative and includes describing and scheduling the activities and processes to assess (identify and analyse), mitigate, monitor, and document the risk associated with a project. Thus planning begins by developing and documenting a risk management strategy. Early efforts establish the purpose and objective, assign responsibilities for specific areas, identify additional technical expertise needed, describe the assessment process and areas to consider, delineate procedures for consideration of mitigation and allocation options, and dictate the reporting and documentation needs, and establish report requirements and monitoring metrics. This planning should also address evaluation of the capabilities of potential sources as well as early industry involvement.

Following the previous sections together with this, it is evident that

there is need for institutional policy documents on risk management. The findings therefore are that (1) the institutional policy documents do not deal adequately with risk management issues.

In contrast, the positives are (1) overall, the institution includes (introduce) risk management its planning and operational processes to some extent (2) there are mitigating controls for the key risks which are embedded into the institution's business processes (3) external auditors conduct audits as part of statutory regulation (4) and lastly, the institution has considered both financial and non-financial risks(e.g., reputation, fraud, health and safety, business continuity) in its strategic objectives (cf. Table 5.3.6.1).

The next section for consideration is risk quantification.

5.2.7 Risk quantification process

In this section, distributions are shown statistically using the components of the likelihood and impact of occurrence of various variables under risk quantification. This is subsequently followed with the main findings of each component in relation to research question two and four.

In chapter two (cf. section 2.3 organisational risk management-IRM modeling and tools), IRM modelling was explained as a method(s) by which risk and risk measures are determined. Researchers (Epstein et al., 2005; McNeil et al., 2005; Haimes & Wiley, 2004; Nicholas, 2004; Bedford & Cooke, 2001; Turban & Meredith, 1994) who ascribe to determination by quantifying risk, however, caution what the institution considers as ‘risk’ and ‘measures of risk’.

In chapter two (cf. section 2.2), Nicholas (2004) notes that there is always a difference in the specific definitions of risk and for that matter measures of risk. One of the best known measures of risk is variance or standard deviation. It is a statistical measure of the dispersion around an expected value (say mean) whereby a larger variance or standard deviation indicates greater dispersion (cf. ch. 4). Although, there are numerous potential measures of risk in the field of mathematical and

statistical[35] risk management, for the purpose of this research and in subsequent discussion, the research uses a few[36], which include standard deviation, skewness and kurtosis as well as Bayesian Analysis. The discussion of measures of risk (cf. chs. 2 and 4) in this section is divided into likelihood of occurrence of risk and impact of occurrence of risk.

5.2.7.1 Analysis of likelihood of occurrence of risk and its implication to the University

Regarding this section and a recall from chapter two section 2 (cf. quantification of risk), it was suggested that the computational technique of converting numbers and text data into unique integers and storing the data along with its context is not an easy task. But what was of importance was that translating text data into unique integers in institutions such as an HEI and their regulatory bodies may provide a level of confidence in their ability to take actions to operate within established parameters.

An example of likelihood ratings for institutions risks may be:; 'highly' unlikely', 'unlikely', 'may happen', 'likely' and 'almost certain'. Depending on where an analyst works he/she can put likelihood percentages next to these classifications to increase people's certainty about what they mean (cf. chs. 2 & 4). For instance, the insurance industry uses historical information and sophisticated [37]models-quantitative risk management- (Monte Carlos simulation, scenario analysis, game theory, stochastic differential equations, Bayesian analysis, regression/multivariate analysis) to work out how likely you are

[35] It is strongly advised that for further understanding on mathematical and statistical methods for risk analysis, see Markowitz Portfolio Theory (MPT). This is out of the scope of the research.

[36] For more on measures of risk and Bayesian analysis see chapter 2-3 and authors such as Turban & Meredith, 1994; Epstein et al., 2005; Nicholas, 2004; Bedford & Cooke, 2001; McNeil et al., 2005; Slywotzky, et al, 2005; DeLoach & James 2000; Schmidt, 1997; Eberlein et al., 2003; Liebenberg & Hoyt, 2008; Beasley & Hermanson, 2005; Hausken, 2002; Kunreuther, 2002; Major, 2002.

[37] Although, some of the models would be applied, this doctoral work cannot cover all the aspects of the vast and growing field of quantitative risk analysis. For further reading I refer readers to books of McNeil et al. (2005) (for quantitative risk management in general), or Crouhy, Galai & Mark (2001) (for institutional aspects of risk management).

to be robbed or die of a heart attack. Arguably, HEIs are not yet at this stage of sophistication, in consequence using such mathematical approach to modeling risk (cf. chapter 2 section 2.4). However, there are many reports and studies published that show common risks and how frequently they occur. Nonetheless, the discussion of Table 5.11 (cf. appendix C1) and related variables (Tables) demonstrate how quantitative risk management is modeled in this study with respect to the case University.

The first category of variable under investigation is shown in Table 5.11 that is - what likelihood of occurrence of risk is associated with below target 3rd stream income (cf. chapter 2 section 2.4 for details)? Table 5.11 (cf. appendix C1) represents the variables that indicate preliminary risk quantification. This is preliminary in the sense that part of the result was used in the mathematical model (Bayesian analysis) that subsequently was discussed. The Table shows that over two-thirds (81.3%) of respondents asserted that the likelihood of an occurrence of risk associated with below target of 3rd stream income was not likely to be met once in an academic year. This suggests that the institution faces the risk of not meeting its operating income as viewed by the majority of respondents (81.3%).

To support the 3rd stream income, the University often depends on the fees recovered from students. Noting from the above indexes and coupled with the interviews sessions, Lin stated (a respondent) that:

> the university's recovery rate of students fees as at the academic year 2008/2009 was in the neighbourhood of 90% per academic year. That amounted to the money (fees) recovered from students per academic year.

But as an interviewee (Xolani) added, (cf appendix D for transcript)

> ...it takes long period to recover it (sometimes in a new academic year).

Literature (Standard & Poor, 2005; Henkel, 2002) advocates that in such instances, the policy of the university should be adhered to. In relation to this research, the policy of the university requires that it recovers funding from students between the months of August or September, but instead, the debt is recovered only around March of each following year as aforementioned. This puts the university at risk for cash-flow management and its capacity to operate.

When the question of percentage of third stream income was raised, respondents noted that this depended on how the university defined it, because every university has its own definition (Standard & Poor 2005; KPMG, 2008). The definition for the case study from Goba, an interviewee was:

> ... money that comes to the university for which council can exercise its discretion and has control over. By that it would be the institution's interest income, the surplus generated from projects or funded projects the excess that flows, the investment in assets that come as a result of project funding.

But as the interviewees explained, the university's sources of 3rd stream income were generated from a variety of sources. ascertained during the interview, in the year 2008, the university benefited either in the form of bursaries and or interest, investment in assets, and acquisition of assets to the extent of about 35 million rand, which was about 8% to 9% of the university's income base. This to a large extent marks a good start for the university in terms of generating 3rd stream income. One respondent (Lin) (cf appendix D for transcript) commented that:

> That is not too bad but in other institutions it is much higher. That is about around R30 million, some of which is used to fund a project, to fund a bursary students ....

Lin maintained that his comment is a good indicator in terms of generating 3rd stream income, as the HEFCE (2001) noted, funders

will not give you money if they feel an institution can not manage it or add value to it.

The next category of variables investigated was as shown from Tables 5.12-5.14. What likelihood of occurrence of risk is associated with below target in pass rates for all students?

With regards to the likelihood of not meeting the target in pass rates for students in the institution, a similar view (70.3%), was expressed.

The implication here is that since the University's mainstream income includes 3rd stream income , which is limited as alluded to by respondents, it is suggested that the university would not be financially sound to meet its objectives set out for a particular academic year, thus, posing financial risk in managing both human and infrastructural resources.

Similarly, a majority (65.6%) (cf. 5.13) supported the notion that once a year there is the likelihood of not meeting percentage throughput targets. It was also evident in terms of percentage throughput targets that the University does not meet in quarterly (21.9%) percentage throughput targets as evidenced in Table 5.12(appendix C2). What this means is that since the university does not meet the target set out for throughput, which is one of the indicators of quality of programme an offer, it affects the number of students graduating each year and hence the subsidy from government.

Table 5.13: What likelihood of occurrence of risk is associated with throughput targets met in the institution

	Frequency	Percent (%)
Rare- Remote possibility (once every 3 years or more)	3	4.7
Unlikely- Could happen but rare (typically once a year)	42	65.6
Possible -Could happen occasionally (on average quarterly)	14	21.9
Likely - Could happen often (on average once a month or more)	2	3.1
Almost Certain- Could happen frequently (once a week or more)	3	4.7
Total	64	100.0

Regarding the trend noted in the above Tables, the same cannot be said about the likelihood of risk associated with not meeting the target of allocation of infrastructure (cf. ch 2: 19) in Table 5.14 below. Over one-half (65.6%) were of the view that there was a likelihood of not meeting the target set forth by the institution under one academic year. In this composite percentage (65.6%), while a one- fourth (25%) of the total responses thought quarterly, there was the likelihood of occurrence of risk associated with not meeting the targets set by the university, another one-fourth agreed that there was a likelihood of risk associated with not meeting the target on average once a week. Less than one-fourth (15.6%) thought the risk of this happening was within a monthly basis as seen in Table 5.14.

In terms of this variable, it may appear worrying for a researcher, once the composite value was less than one academic year is as huge as seen above, the reason being that a business cycle in the university was normally within one academic year. Which suggest that if the risk as noted above was that high, then the likelihood of not meeting the objectives of the University within that academic year would ultimately be high. This may

correlate well with the previous Tables where most responses attributed the likelihood of risk occurrence to this (variable) and other variables mentioned above as not being met less than one academic year.

The next variable dealt with the likelihood of occurrence of risk associated with below target of allocation of infrastructure. Table 5.1.4 suggests that about one-fifth (25%) suggested that likelihood of occurrence of risk associated with below target of allocation of infrastructure was possible – that is could happen occasionally (on average quarterly). About a third (34.4%) suggested that likelihood of occurrence of risk associated with below target of allocation of infrastructure was unlikely- could happen but rarely (typically once a year). Another one-fifth (25%) of respondents indicated likelihood of occurrence of risk associated with below target of allocation of infrastructure was almost certain, suggesting that it could happen frequently (once a week).

The implication to the University is that there is sufficient evidence to suggest that infrastructurewise, the University needs to improve on the risk associated with infrastructure. Recall from Tables 12 and 13 of the inadequacies of pass rate and throughput. This may be a ripple effect from insufficient pass rate and throughput together with 3rd stream income which hinder the university from managing its resources as evidenced in Table 5.14.

Table 5.14: The likelihood of occurrence of risk associated with below target allocation of infrastructure

	Frequency	Percent (%)
Unlikely- Could happen but rare (typically once a year)	22	34.4
Possible -Could happen occasionally (on average quarterly)	16	25.0
Likely - Could happen often (on average once a month)	10	15.6
Almost Certain- Could happen frequently (once a week)	16	25.0
Total	64	100.0

The other variable (likelihood of occurrence of risk associated with below target of teaching staff with Masters and or Doctorates) investigated is as shown in Table 5.14.1. In terms of human capital, particularly academic staff qualification targets set forth by the university, Table 5.14.1 reveals that where as there is a low percentage (15.6%) likelihood of occurrence of risk associated with not meeting a target set forth by the university in relation to qualified staff with masters and doctoral degrees, the majority responded that the likelihood of risk of not meeting the target was over two-thirds (73.4%) of the total responses.

Table 5.14.1: The likelihood of occurrence of risk associated with below target of teaching staff with Masters and/or Doctorates

	Frequency	Percent (%)
Rare- Remote possibility (once every 3 years or more)	1	1.6
Unlikely- Could happen but rare (typically once a year)	47	73.4
Possible -Could happen occasionally (on average quarterly)	10	15.6
Likely - Could happen often (on average once a	4	6.3

month or more)		
Almost Certain- Could happen frequently (once a week or more)	2	3.1
Total	64	100.0

The last variable investigated in the above sub-section (5.3.7.1 Likelihood of occurrence of risk) was the likelihood of the occurrence of risk associated with below target of teaching staff with Masters and or Doctorates. It was revealed that a bigger percentage (73.4%) maintained that the institution was not likely to meet the target set in terms of teaching staff with Masters and or Doctorates. This has a negative implication on the University, since quality of teaching staff affects the ability to deliver quality proper teaching.

To sum up the findings of the likelihood of occurrence of risk in this section, an analyst needs to take cognisance of various model(s) that can be used in predicting the likelihood of occurrence of risk factors. As in this case, this is predominantly based on the likelihood of occurrence using percentage frequency as shown in the various Tables. Note that for other model(s) other percentages may be suitable (cf. ch. 2 section 2.2).

The main findings of the section included: (1) The data (81.3%) showed that the likelihood of occurrence of risk associated with below target of 3rd stream income was likely not to be met, once in an academic year (2) With regards to the likelihood of not meeting the target in pass rates for students in the institution, a similar (70.3%) view as happening once within a year was revealed (3) Similarly, the notion that once a year there is the likelihood (65.6%) of not meeting percentage throughput targets was a matter of concern.

Thus in terms of academic staff, particularly academic staff qualification targets set forth by the university, the data revealed that whereas there is a low (15.6%) percentage likelihood of occurrence of risk associated with not meeting a target set forth by the university in relation to qualified staff with masters and doctoral degrees, the majority (73.4%) responded that the likelihood of risk of not meeting the target was a serious matter of concern.

5.2.7.2 Analysis of impact of occurrence of risk and its implication to the University

Regarding this section I start by showing statistically the components of the impact of occurrence of risk quantification. This is then followed with the main findings of each the components of the impact of occurrence of risk.

The above presentation of data reveals the likelihood of occurrence of risk associated with various variables set forth in preliminary quantification of risk. It is important to note that definition of risk (cf. ch. 2) is a function of the likelihood and impact of occurrence of risk[38]. Thus, in quantifying risk, an analyst identifies the impact together with the likelihood of the risk to be able to understand and appreciate the severity of the risk should the risk happen/occur.

In the following data presentation, the section reveals various variables associated with the impact of risk. The impact of risk details the debate and or probes further the argument that if there is the likelihood of an event[39] occurring given an index for such likelihood of occurrence then what would be the impact of the event should the event occur? The answer to this question of impact of occurrence of events in this study of risk is as discussed below with various indexes signifying the degree of impact. This is followed by a further impact analysis of the indexes.

The first variable investigated was impact of occurrence of risk associated with below target of 3rd stream income. Table 5.15 reveals that nearly two-thirds (68.8%) agreed that typically, the impact of occurrence of risk associated with below target of 3rd stream income is certain once a year. Comparatively, this impact and its likelihood of occurrence simultaneously happens in one academic year as seen above. About a fourth (20.3%) asserted that the impact (of occurrence of risk associated with below target of 3rd stream income**)** is significant but, its occurrence is on average quarterly. In both insignificant occurrences (once in three years) and major impact of

[38] Noting that the risk is irrespective of its type- thus the same formula Risk = f (likelihood, Impact) is often used.

[39] In this research event is defined as a risk factor- it is important to note that both in mathematical modeling and or probability theory the terms may be interchangeable.

occurrence, the indexes were far below (3.1% respectively) that of the minor and moderate impact as seen below, suggesting that the effect of the impact is relatively insignificant compared to minor- Could happen but rare (typically once a year) (68.8%).

Table 5.15: What impact of occurrence of risk is associated with below target 3rd stream income?

	Frequency	Percent (%)
Insignificant -Remote possibility (once every 3 years)	2	3.1
Minor- Could happen but rare (typically once a year)	44	68.8
moderate- Could happen occasionally (on average quarterly)	13	20.3
Significant- Could happen often (on average once a month)	3	4.7
Major- Could happen frequently (once a week or more)	2	3.1
Total	64	100.0

Typically in once a year, more than two thirds (68.8%) thought the impact of occurrence of risk was associated with below target in pass rate for all students, meanwhile, about one-third of that Figure revealed that the impact is on a quarterly basis.

A similar trend was revealed in relation to the impact of occurrence of risk associated with not meeting percentage of throughput targets. While the majority (68.8%) alluded that the impact of occurrence of risk is typically in once a year, nearly one-fourth (18.8%) saw the impact to occur in once very month. In this instance the marginal percentage of the impact in three years, once a month and a week were not of major concern as measured by the percentage of response.

In the case of impact of occurrence of risk associated with below target of academic staff in research, the responses were somewhat worrying, because, while in one academic year the impact of occurrence

was 42.2%, in contrast, the majority (46.9%) alluded that the impact of the risk of not meeting the target of academic staff in research is quarterly. The implication is that once research output is minimal and does not generate subsidies from government, it means that the operating income of the university is limited such that research related projects are given least attention and hence limited revenue generated for the University

Whereas there were clear disparities as shown in the above variables, there were no such wide gaps in terms of the impact of occurrence of risk associated with below target of allocation of infrastructure. Table 5.16 shows that the neighborhood of a quarter (26.6%) noted that the impact is within once in an academic year. While another quarter noted that the impact could occur on average once quarterly which is matter of concern. It is important therefore the University evaluates allocation of infrastructure to enhance the life of infrastructural base. Amongst the responses provided in Table 5.16, the popular response was the occurrence within a period of once a month, which invariably poses a matter of concern to the institution. Amongst other things, these infrastructures include buildings, computers, library resources and laboratory equipment

Infrastructure in this study is defined as the University's physical assets that are capable of an intended service delivery, and which comprise of rigid assets such as the built environment including buildings, library, lecture hall, residences, computer and laboratory facilities that relate to university services. From the above, infrastructure risk is approached from the point of view that it is principally concerned with undesired events, and is tied to the prospect of being a threat.

Defining infrastructure risk is complicated in that it can be divided into two parts; likelihood and impact. When a risk is even considered from the perspective of likelihood, the decision as to whether it would be construed to be a threat depends on how likely the occurrence of the event would be. However, even if the likelihood of the event is deemed too low, the decision as to whether it would be construed to be a threat depends also upon the resulting consequences of the impact.

Infrastructure risk management however, requires a holistic approach to assessment of the vulnerability of critical infrastructure, and can be envisaged as an iterative process ranging from identification of internal and external sources of risk impacts, through to hazards and risk analysis, monitoring, modeling and prediction, risk mitigation and consequence recovery. Such a holistic approach to a vulnerability assessment of critical infrastructure can be important. A general view of the state of affairs in terms of infrastructure receives attention as a whole, since the various parts as discussed in chapter 2 do not operate in silos (cf. ch. 2 and ch. 6 for details).

Table 5.16: The impact of occurrence of risk associated with below target of allocation of infrastructure

	Frequency	Percent (%)
Minor- Could happen but rare (typically once a year)	17	26.6
moderate- Could happen occasionally (on average quarterly)	16	25.0
Significant- Could happen often (on average once a month)	23	35.9
Major- Could happen frequently (once a week or more)	8	12.5
Total	64	100.0

- **The impact of occurrence of risk associated with below target of teaching staff with Masters and or Doctorates**

In relation to teaching staff with masters and doctoral degrees, the majority (79.7%) noted that this was not a matter of concern as per the impact of occurrence of risk associated with it. This index suggests that there is a relatively low risk impact in relation to that variable as evidenced by the index (79.7%). This measure indicates that once in an academic year, the impact is not as significant (4.7%) as it may be (this is not statistical significance is but risk scale). Nonetheless, a reasonable index (15.6%) noted that the impact is quarterly.

On the other hand Table 5.17 below shows a composite

frequency of results of the risk of impact of the various indexes (variables) discussed above. This form of response reveals the occurrence of all the variables in relation to impact. The responses revealed that 59.1% noted that the risk impact of the university typically happens once a year. What this suggests is that there is a need for the University to understand the occurrence within an academic year as indicated by the 59.1% responses.

From the above, there is enough evidence to suggest. That is the frequency of occurrence of the risk factor(s) is predominantly within a period of one year or one academic year of the University. What does this signify? Although in most business cases, business cycles vary considerably depending on the industry and or the institution, this study reveals that, most impacts in this case study happen within the period of one academic year (cf. conclusion for details and ch 6). From economics literature **(**Hansen & Prescott, 2005, Hansen & Imrohoroglu, 2008; Holbert, Benoit & Hansen, 2002), business cycle may be said to be the periodic but irregular up-and-down movements in economic activity, measured by fluctuations in the various desirable factors of the setting, in this case a University and the various risk factors such as risk associated with below target of allocation of infrastructure. Arguably though, a business cycle is not a regular, predictable, or repeating phenomenon like the swing of the pendulum of a clock. Its timing is random and, to large degree, unpredictable.

Few (2.3%) regarded the impact as insignificant thus happening once every 3 years. As measured by the response below, there appears to be no essential difference (3.4%) in terms of impact occurring once a week. About a quarter (24.7%) of the respondents noted that the impact was moderate thus occurring once quarterly. Meanwhile, a neighborhood of one-tenth (10.4%) agreed that the impact was Significant- thus could happen often (on average once a month).

Table 5.17: Composite risk of impact

		Responses	
		N	Percent (%)
Risk Impact	Insignificant -Remote possibility (once every 3 years)	9	2.3%
	Minor- Could happen but rare (typically once a year)	227	59.1%
	moderate- Could happen occasionally (on average quarterly)	95	24.7%
	Significant- Could happen often (on average once a month)	40	10.4%
	Major- Could happen frequently (once a week or more)	13	3.4%
Total		384	100.0%

In chapter two section 2.2, Nicholas (2004) claims that risk is a joint function of the two (likelihood and impact) risk variables representing the goal contents (variables) of risk management. The output presented in Table 5.18 reveals information about the composite of likelihood of occurrence of risk in the university. The output indicates that well over one-half (65.4%) noted that the likelihood of occurrence of the various risk was unlikely- thus could happen but rarely (typically once a year). The above Figure is followed by 17.4% of the respondents claiming that the likelihood of occurrence of risk is possible – thus could happen occasionally (on average quarterly).Under one-tenth (8-6%) noted that the likelihood of occurrence is within a period of a month or in a weeks. The least responses (2.1%) were respondents who affirmed that the likelihood of occurrence of risk is rare- remote possibility (once every 3 years or more).

Table 5.18 Composite risk of likelihood

		Responses	
		N	Percent
Risk Likelihood	Rare- Remote possibility (once every 3 years or more)	8	2.1%
	Unlikely- Could happen but rare (typically once a year)	251	65.4%
	Possible -Could happen occasionally (on average quarterly)	67	17.4%
	Likely - Could happen often (on average once a month or more)	32	8.3%
	Almost Certain- Could happen frequently (once a week or more)	26	6.8%
Total		384	100.0%

The data in this section reveals that the impact of occurrence of risks is predominately once a year. The first conclusion, is that in most business cases, business cycles vary considerably depending on the industry and or the institution; this study reveals that considerably more impact in the University. Secondly, noting from the data above, (1) The impact[40] of occurrence of risk associated with 3rd stream income typically was within once a year (2) and almost similar trend was revealed in relation to the impact[41] of occurrence of risk associated with not meeting percentage of

[40] The first variable investigated was the impact of occurrence of risk associated with 3rd stream income, it was revealed that nearly two-thirds (68.8%) agreed that typically it impact occurs once a year

[41] Majority (68.8%) alluded that the impact of occurrence of risk is typically in once a year,

throughput targets (3) the other two are the impact of occurrence of risk associated with teaching staff and academic staff in university and the impact[42] of the risk of not meeting the target of academic staff in research; these were all quarterly.

5.2.7.4 The predictive power of business risk management models

The aim of this section is to find out information to satisfy the fourth research question. The fourth research question seeks to interrogate the predictive power business risk management models have within higher education institutions. This analysis thus, seeks to find (if any) the contrast of the distributions of both impact and likelihood of risk with respect to various variables. This is concluded with the main findings of the section in relation to research question four, which investigates the predictive power of business risk management models (Nicholas risk model, Bayesian analysis, frequency distribution, measures of dispersion, measures of location inferential analysis- cf. ch.2). But, first it begins with air analysis of quantified risk and the processes involved.

5.2.7.4.1 Analysis of quantified risk

Noting that in this research, risk analysis[43] and processes follow a sequential and procedural technique (cf. chs. 2 section 2.4 for risks and measures of risks) the section makes reference to Table 1 of the data presented firstly, Table 5.19, which presented data in relation to investigation of staff qualification. With identical means, the two variable[44] distributions are similarly centered, noting that variable A's distribution has somewhat more dispersion as measured by standard deviation. In this instance and as discussed in chapter two (cf. section 2.2.2 characteristics of Institutional-wide risk management) the likelihood of occurrence of risk associated with below target of teaching staff with masters and or

[42] majority (46.9%) alluded that view

[43] This doctoral work cannot cover all the aspects of the vast and growing field of quantitative risk analysis. For further reading I refer readers to books of Crouhy, Galai & Mark (2001) (for institutional aspects of risk management).

[44] Represented as A and B

doctorates is riskier as measured[45] by standard deviation. Consequently, the impact of occurrence of risk associated with below target of teaching staff with masters and or doctorates has the better risk –reward profile. In other words low risk profile. The implication is that all else being equal and should the impact associated with the risk be kept as constant (with a standard deviation of 0.535), there would be a brighter reward associated with meeting the target of teaching staff with masters and or doctoral degrees, which supports Nicholas' definition of risk. In other words, once risk is a function of likelihood and impact of an event, (cf. section 5.3.4 above; Risk mitigation), it does suggest that to control and or to mitigate risk, it is mathematically and rationally sound to moderate (keep low) the likelihood of occurrence of risks in relation to the data on the variable staff qualification. See the mathematical treatment below.

It will be recalled that in chapter 2, Nicholas (2004) identified two distinct features of risk, which suggest that risk addresses; (1) the likelihood that some problematical event will occur and (2) the impact of the event if it does occur. Nicholas (2004) expresses the above mathematically as **risk[46] = *ƒ* (likelihood, impact),** which suggests that risk is a joint function of likelihood and impact of risk (cf. ch 2: 19 section 2.2 for details).

Numerically, the index of **risk** $_{(sq)}$ = (0.764) (0.535) = 0.409

Where **risk** $_{(sq)}$ means risk associated with below target of staff qualification.

Inferring from the index and mathematical definition above, this simply means that once **likelihood** and **impact** are directly proportional to risk, and fortunately the magnitude of impact of risk as seen in Table 5.19

[45] Also see good approaches of risks and risks measures by Bayaga (2010) (for value at risk : Single risk factor measurement); Deutsch (2004) (for derivatives and internal models: financial and capital markets); Øksendal (2000) (for stochastic differential equations: an introduction with applications); Morgan (1996) (for RiskMetrics – Technical Document); Runggaldier & Zaccaria (2000) (for a stochastic control approach to risk management under restricted information); Holton (1997) (for subjective value at risk) and Ait Sahalia & Lo (2000) (for nonparametric risk management and implied risk aversion)

[46] cf. ch 2 section 2.2 what is risk and risk management**?** And chapter 4 for risk measures.

is low. Once likelihood of occurrence of risk is controlled, there would be a direct effect on entire **risk** by it being controlled University-wide, hence a brighter risk reward profile.

Table 5.19: Mean and standard deviation of staff qualification

	Mean	Std. Deviation	N
(a) The impact of occurrence of risk associated with below target of teaching staff with Masters and or Doctorates is	2.25	0.535	64
(b) The likelihood of occurrence of risk associated with below target of teaching staff with Masters and or Doctorates is	2.25	0.764	64

The key information here is that all else being equal, it is important than the University makes a serious effort to mitigate the likelihood of occurrence of risk either by keeping its measure (0.764) below its current measure and its comparative measure, that is (impact =0.535). This Figure can be used to predict range of risk associated with the variable under discussion (cf. ch. discussion chapter 6).

Note from Table 5.20, also having identical means, the two variable distributions are similarly centered (as measured by the means). Note that the likelihood of occurrence of risk associated with below target of allocation of infrastructure distribution has somewhat more dispersion, as measured by standard deviation. Thus the likelihood of occurrence of risk associated with below target of allocation of infrastructure is riskier as measured by standard deviation. Accordingly, the impact of occurrence of risk associated with below target of allocation of infrastructure has the better risk –reward profile. This suggests that all else being equal and should the impact associated with the risk be kept as constant (with a standard deviation[47] of 1.011), there will be a brighter reward associated with meeting the target of allocation of infrastructure. The likelihood

[47] See chapter 4 for risk and measures of risk.

should be managed. Inferring from the mathematical definition above, this simply means that once **likelihood** and **impact** are directly proportional to risk, the magnitude of impact of the risk as seen in Table 5.20 is low and, then numerically, it makes sense to control[48] and mitigate the likelihood of the occurrence of the risk. Once likelihood of occurrence of risk is controlled, there would be a direct effect on entire **risk** being controlled University-wide, hence a brighter risk reward profile.

Numerically, the index of **risk** $_{(ii)}$ = (1.194)(1.011) = 1.207

Where **risk** $_{(ii)}$ means risk associated with below target of institutional infrastructure

Table 5.20: Mean and standard deviation allocation of institutional infrastructure

	Mean	N	Std. Deviation
(a) The likelihood of occurrence of risk associated with below target of allocation of infrastructure	3.34	64	1.194
(b) the impact of occurrence of risk associated with below target of allocation of infrastructure is	3.34	64	1.011

Inferring from the Table 5.21, variable B is centered to the right of variable A, as indicated by their means. But, variable B's distribution has somewhat more dispersion than A's. Both distributions are asymmetric, but in different ways. The distributions for variable A are slightly negatively skewed. Variable B's distribution is moderately positively skewed. Variable A is mesokurtic, and variable B's distribution is slightly platykutic as measured by kurtosis. From the above therefore, a researcher may not know which variable the University would prefer to keep under moderation

[48] Note that 'Control' in this research is taken as to reduce to the minimal extent either by subjective and objective.

due to the variability in the means, skewness and excess kurtosis. Note that variable B has a higher mean and moderately positive skeweness, but it also has more risk as measured by standard deviation.

Table 5.21: Mean and Standard deviation of pass rates.

	N	Mean	Std. Dev	Skewness	Kurtosis
(A) What impact of occurrence of risk is associated with below target in pass rates for all student groups of the institution	64	2.33	0.691	-0.139	-0.187
(B) What likelihood of occurrence of risk is associated with below target in pass rates for all student groups of the institution	64	2.41	0.791	0.493	-0.852

The above variability gives an indication that at this stage, risk calculated and subsequent decisions made are likely to be erroneous. This is due to the degree of variability as noted above, suggesting and warranting further analysis.

The realised mean in Table 5.21 on variable B appears to have been different than the mean in variable A. The question now is, was the difference statistically significant for the inference made above? The above is answered as shown below. Letting μ_1 stand for the mean for variable A and μ_2 stand for mean for variable B in the 5.21, a formulated hypothesis is as: H_o = The mean on variable A is equal to the mean of variable B. H_a = The mean on variable A is not equal to the mean of variable B. This is represented as: Ho : $\mu 1 - \mu 2 = 0$ versus Ha : $\mu 1 - \mu 2 \neq 0$.

Using N_A and N_B as number of sample sizes of variable of A and B which equals 64 respectively, it implies that df = 130. Using a Table of the student's t-distribution, the closest df to 130 is 120. Thus for a two-sided test, the rejection point is ± 1.980 for 0.05 level of significance for df = 120. To summarise, at the 0.05 level, we reject the null if t < -1.980 or t > 1.980. With a t value of 1.997, the t is significant at the 0.05 level. Based

on the value of 1.997, we reject the null hypothesis at 0.05. Thus some evidence exist that mean on variable A differs with mean on variable B.

Going back to the first inference above, the test concerning differences between means supports the suggestion that variable B has a higher mean and moderately positive skewness, but it also has more risk as measured by standard deviation. Hence, at this point, the University can make a decision based on Nicholas's (2004) risk definition.

Inferring from Nicholas's (2004) mathematical definition of risk and Table 5.21, this simply means that once **likelihood** and **impact** are functions of risk, and since the magnitude of impact of risk as seen in Table 5.21 is low, then numerically, it does suggest a control and a subsequent mitigation of the likelihood of occurrence of the risk. Once likelihood of occurrence of risk is controlled, there would be a direct effect on entire **risk** by it being controlled University-wide, hence a brighter risk reward profile.

Thus numerically, the index of **risk** $_{(prs)}$ = (0.791)(0.691) = 0.954

Where **risk** $_{(prs)}$ means risk associated with below target of pass rates.

To further support the claims above, it is imperative to address the question of risk preference for the purpose of benchmarking the means and standard deviations. For this reason, a further statistical analysis was conducted in relation to percentiles. These indexes form a standard of measure for the various statistics should the university intend to benchmark the various impacts and likelihood levels. With regards to Table 5.21, for instance, the university may now use Table 5.22: as a benchmark for risk preference. Thus in relation to the mean of a 50th mark which corresponds to 2.27 for variable A, the standard deviation indicates a 75th percentile corresponding to 0.718 for variable A.

Table 5.22: Benchmark indexes

	N	Mean	Std. Deviation	Minimum	Maximum	Percentiles		
	25th	50th (Median)	75th	25th	50th (Median)	75th	25th	50th (Median)
(A) What impact of occurrence of risk is associated with below target in pass rates for all student groups of the institution	64	2.27	0.718	1	5	2.00	2.00	2.75
(B) What likelihood of occurrence of risk is associated with below target in pass rates for all student groups of the institution	64	2.38	0.826	1	5	2.00	2.00	3.00

The key information is that all else being equal, there is a strategic reason, stemming from the mathematical treatment to manage the likelihood of occurrence of risks associated with below target in pass rates for all student groups of the institution. Risk is a function of likelihood and impact of occurrence of risk. In which case, comparatively, the impact of occurrence of risk is lower as evidenced above in Table 5.21.

The final analysis related to the statistical and risk quantitative analysis intended for probing the university's academic staff active in research as well as throughput targets met in the institution. Following the presentation in Table 5.23 below, and with identical means, the distributions are similarly centered. Variable B's distribution has somewhat more dispersion, as evidenced by standard deviation. Both variables are negatively skewed to the same degree. Both variables have very large excess kurtosis, indicating much more frequent risk at the extremes, both positive and negative, than for a normal distribution.

Inferring from Table 5.23 with identical mean and skewness, a risk analyst can conclude based on Nicholas's (2004) mathematical

assertion of risk (cf. chs. 1 and 2). Applying the mathematical formula similar to the other variables above, it can be noted that variable B is riskier as measured by standard deviation. Furthermore, a risk-averse University might view variable B's greater kurtosis, an additional risk element. Consequently, it makes sense to say variable A has the better risk-reward profile.

The indexes in Table 5.23 suggest that all else being equal and should the likelihood associated with the risk be kept low (with a standard deviation of 5.546), there would be a brighter reward associated with meeting the target of academic staff active in research.

Table 5.23 Mean and Standard deviation academic staff active in research

	N	Mean	Std. Devi	Skewness	Kurtosis
(A) The likelihood of occurrence of risk associated with below target of academic staff active in research	64	2.55	5.546	-2.260	6.2584
(A) The impact of occurrence of risk associated with below target of academic staff active in research is	64	2.55	6.401	-2.260	8.049

In conclusion, Table 5.24 reveals identical means for percentage throughput targets met in the institution. This as noted in chapter two sections 2.2.2.4 and 2.3.1 is one of the most important variables in the University, note that the two distributions are similarly centered. Variable B's distribution has somewhat less dispersion, as specified by standard deviation. Both distributions are asymmetric but in different ways. The distribution for variable A is negatively skewed; variable B's distribution is positively skewed.

Inferring from the indexes above together with Nicholas's (2004) mathematical definition of risk, the university would prefer the distribution of variable B, which has the same mean as variable A, but less risk as evidenced by standard deviation. Furthermore, variable

B's risk is positively skewed, indicating a higher frequency of very large positive rewards relative to variable A. In contrast. Variable A is negatively skewed. The next stage is to predict and forecast events based on available index for future use.

Table 5.24: Mean and Standard deviation of percentage throughput targets met in the University

	N	Mean	Std. Dev	Skewness
(A) What likelihood of occurrence of risk is associated with percentage throughput targets met in the institution	64	2.38	8.330	-1.260
(B) What impact of occurrence of risk is associated with percentage throughput targets met in the institution	64	2.38	7.700	3.260

With reference to Tables 5.22, 5.23 and 5.24, the main findings are six folds (1) To control and or to mitigate risk, it is sound to moderate (keep low) the likelihood of occurrence of risks as compared with its impact in relation to the data on the variable [49]staff qualification, suggesting an issue of confounding variable (2) Once likelihood of occurrence of risk (variable A) is controlled, there would be a direct effect on entire [50]**risk** by it being controlled University-wide, hence a brighter risk reward profile (3) Once likelihood of occurrence of risk[51] is controlled, there would be a direct effect on entire **risk** by it being

[49]Noting that variable A denotes 'The impact of occurrence of risk associated with below target of teaching staff with Masters and or Doctorates is'

[50] And variable B denotes 'The likelihood of occurrence of risk associated with below target of teaching staff with Masters and or Doctorates is'.
Noting that variable A denotes 'The likelihood of occurrence of risk associated with below target of allocation of infrastructure'
And variable B denotes 'T he impact of occurrence of risk associated with below target of allocation of infrastructure is'.

[51] cf. table 5.21

controlled University-wide, hence a brighter risk reward profile (4) All else being equal and should the likelihood associated with the risk be kept as constant, there would be a brighter reward associated with meeting the target of academic staff active in research as compared with its impact (5) The chief information is that all else being equal, there is reason to manage the likelihood of occurrence of risks associated with below target in pass rates for all student groups of the institution as compared with its impact of occurrence of risk (6) Inferring from the indexes above, the university would prefer the distribution of variable[52] B, which has the same mean as variable A, but less risk as evidenced by standard deviation (cf. ch. 6 for details).

5.2.7.4.2 Mathematical Model: Bayesian Analysis

The question that follows in most of the analysis made above is 'what probability theory has to say about learning from experience'. That is what can be learnt from already existing data? With reference to the research question four, which interrogates the predictive power business risk management model has within higher education institutions quality management, it would interest any analyst to be able to predict/forecast events of the future with some relative objectivity. To attain the objective of prediction, an analyst could use Bayesian analysis as described in chapter two to update probability of one event given new information (cf. ch. 2- Bayesian analysis).

To answer the question 'what probability theory has to say about learning from experience', the section starts with a reminder and analysis of Bayesian formula. When institutions make decisions involving risk, they often start with viewpoints based on their experience and knowledge to generate the indexes seen above. These viewpoints may be changed or confirmed by new knowledge and

[52] Recall that variable A denotes 'What likelihood of occurrence of risk is associated with percentage throughput targets met in the institution'
Variable B denotes 'What impact of occurrence of risk is associated with percentage throughput targets met in the institution'

observations as time moves on. Baye's' formula is a rational method for adjusting the viewpoints as the institution confronts new information, in which case, Baye's formula makes use of the equation noted in chapter 2 to answer the question above, using the Total Probability Rule. Thus, in general, Baye's formula uses the occurrence of an event to infer the probability of a scenario generating it. For that reason, Baye's formula is sometimes called an inverse probability. In many illustrations, including its application in this research, an individual updates his/her beliefs concerning the causes that may have produced a new observation. For the illustration and application of Bayesian analysis in this research, follow the discussion below with reference to Table 5.21.

With the above reminder of Baye's analysis together with the inferences to be made from Table 5.21 (above) and 5.25 (appendix C3), the researcher uses the occurrence of an event (likelihood-variable B) to infer the probability of a scenario (impact-variable A) generating it, thereby predicting, updating and making further inferences.

Since, the variables in Table 5.21 can result in positive returns, and negative returns often have the opposite effect for sustainability of the university, it suggests that it is a matter of necessity to carry out this analysis in the institution. To proceed with above, first the University prepares a list of alternatives amongst, which may include the release of the year's standard deviations for the variables (1) that exceeded the consensus standard deviation-SD estimate, or (2) the years' standard deviations-SD exactly meeting the consensus standard deviation-SD estimate, or (3) the years' standard deviations-SD falling short of the consensus standard estimate.

On the basis of the research, the following prior probabilities (or priors, for short) (cf. ch. 2) can be recorded down concerning these three events mentioned above noting from Table 5.25 (see appendix).

- P(SD exceeded consensus) = 0.45
- P(SD met consensus) = 0.30

- P(SD fell short of consensus) = 0.25

These probabilities are 'prior' in the sense that they reflect only what the University knows now, before the arrival of any new information. If, next year, the university intends to announce that it is expanding or increasing student pass rate (in this case progression from one year to the next), in its three campuses to meet increased demand from say government requirements this becomes new information with two assumptions. The first being that the decision to expand capacity relates not only to current demand, but also to the prior year's demand. Secondly, knowing that pass rate probabilities (counts) are related to the observed and expected count generated from Table 5. 25 (appendix C3).

The question the university is, 'in light of the new information, what is the updated probability that the prior year's SD probability exceeded the consensus estimate?' Baye's formula provides a rational method for accomplishing this updating. The new information can be abbreviated as 'university expands'. The first step in applying Baye's formula is to calculate the probability of the new information (here: university expands), given a list of events or scenarios that may have generated it. The idea is that the list of events should cover all possibilities, as it does here. Formulating these conditional probabilities is the key step in the updating process. Suppose then the university's view[53] is

P (university expands SD Probabilities exceeded consensus) = 0.75
P (University expands SD Probabilities met consensus) = 0.20
P (University expands SD Probabilities fell short of consensus) = 0.05

Conditional probabilities of an observation (here: university expands) are sometimes referred to as likelihoods. Again, likelihoods are required for updating the probability. Next, you combine these conditional probabilities with your prior probabilities to get the

[53] At this point, the university makes decisions based on what needs to be met by the government and or their intention.

unconditional probability for university expanding,

P (university expands), as follows:
P (university expands) = P (university expands SD Probabilities exceeded consensus)
X P (SD exceeded consensus)
+ P (University expands SD Probabilities met consensus)
X P (SD met consensus)
+ P (SD met consensus)
X P (SD fell short of consensus)
= 0.75(0.45) + 0.20 (0.30) + 0.05 (0.25)
= 0.41, or 41%
This above equation using the total probability rule is what generates 41%. Now the University can answer the question by applying Bayes' formula:

P (SD exceeded consensus university expands)
= P (university expands SD exceeded consensus) P (SD exceeded consensus) P (University expands)
= (0.75/0.41) (0.45)
= 1.829268 (0.45)
= 0.823171

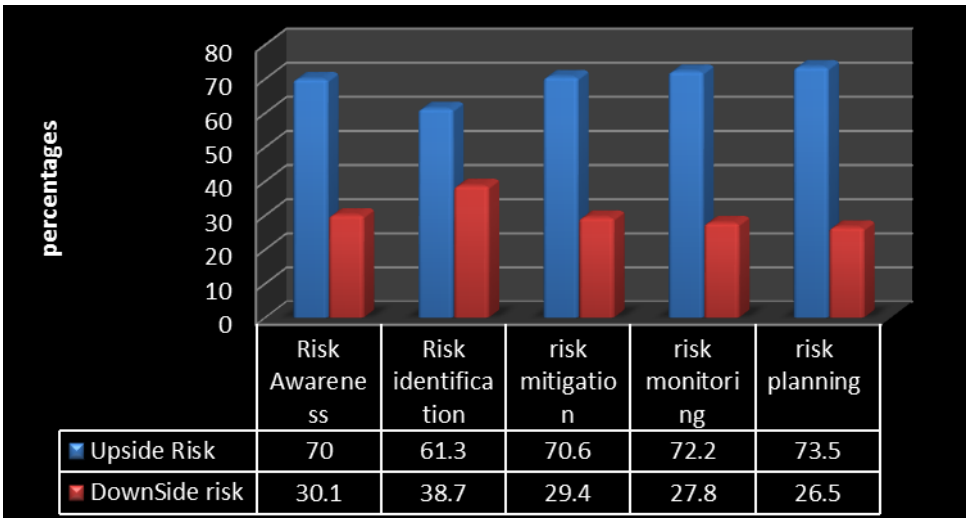
Prior to University's announcement, it was thought that the probability that the University would beat consensus expectations was 45 percent (see above). On the basis of interpretation of the announcement, the University update's that probability to 82.3 percent. This updated probability is called the University's posterior probability, because it reflects or comes after the new information. Baye's' calculation takes the prior probability, which was 45 percent, and multiplies it by a ratio- the first term on the right-hand side of the equal sign. The denominator of the ratio is the probability that university expands, as one view's it without considering (conditioning on) anything else. Therefore, this probability is unconditional. The numerator is the probability that university expands if the year's SD probabilities actually exceed the consensus estimate. This years' probability is larger than the unconditional probability in the denominator, so the ratio (1.83 roughly) is greater than 1. As a result, the updated or posterior probability is

larger than the initial probability. Thus, the ratio reflects the impact of the new information on prior beliefs.

5.2.8 Ranking Effective Composite Risk Management Process in the University

Recalling chapter two section 3.3, this study indicates that the IRM process includes the total and a balanced application of various IRM processes viz: risk awareness, risk identification, risk mitigation, risk monitoring and risk planning. With regards to the composite results cited (cf. sections such as 5.2.2.2- composite risk awareness responses and others), it was evidently clear that in terms of the five (5) main IRM process grouped into upside risk (cf. ch. 2 section 2.1 and 2.2), that is the certainty of future outcomes, risk planning was given the most (73.5%) attention in the University. This was closely followed by risk monitoring (72.2%). The other two closely related variables were risk awareness (70%) and risk mitigation. This has its own implication as suggested in section 5.3.1 and chapter 6.

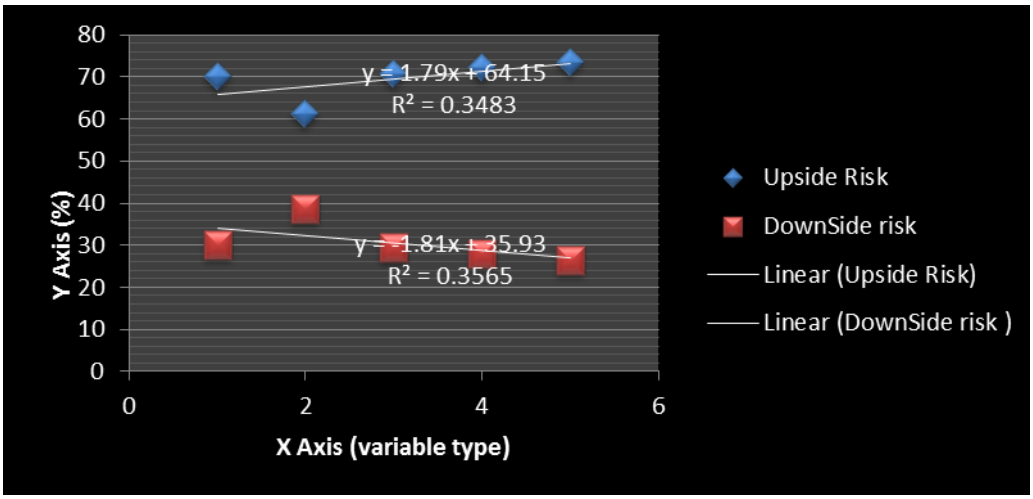
Table 5.26: Ranking Effective Composite Risk Management Process in the University



It is interesting to note from Table 5.26 of the trend of results in relation to downside risk. With regard to downside risk variables (which means

the uncertainty of future outcomes) it is evident that there is an inverse proportional relationship between risk identification and risk planning (cf. Table 5.26). This relationship is seen in the linear equation generated for both upside and downside risk in Table 5.27. Thus, for upside risk the formular will be y=1.79x+64.15 while for downside y=1.81x+35.93.

Table 5.27: Regression Analysis of Upside and Downside Risk



Thus in general, if upside risk is represented as Y^{ur} and downside risk is represented as Y^{dr}, then mathematically, this study concludes that; Y^{ur} ά $^{1}/_{Ydr}$.....(1)

Referring to chapter two, section 2.4.3 (cf. methods based primarily on analysis of historical data-regression analysis), this study argues that, often it is necessary and useful to develop a model of a variable by examining its drivers or causal variables. For this reason, McNeil et al. (2005) suggest that a regression equation expresses this purpose thus a dependent variable as a function of one or more predictor variables. This suggests one important ramification for the University (the case); that is it is a business imperative to work out model to manage risk. In this regard and with reference to chapter two (cf. section 2.2), this thesis proposes that risk management takes two inversely proportional relationship or stages; upside risks and downside

risks. This implies that, in the case of this study, university managers need to (1) identify and improve the risk factors within the time and resource limits of the upside risk (2) take action to reduce the likelihood of a downside risk as the equation illustrates. Thus, for the ramification to succeed, risks in a parsimonious model are a challenging task. Hence, categorising risk in both upside and downside risks respectively helps to diagnose possible consequential relationships between the phenomenon and the outcomes of interest, and helps to structure risks based on their causes and levels of predictability (cf. equation 1).

Consistent with previous studies (Embrechts,2008; Feller,2008;Embrechts, Degen & Lambrigger, 2007; McNeil et al., 2005; Szeg, 2005; Haimes &Wiley, 2004), this study analysed IRM risks using this two dimensional framework, upside risk and downside risk. The framework emphasises that a University can create risk awareness, identify, analyse and monitor risks in IRM process by adapting this research framework via the equation Y^{ur} is proportional to $^{1}/_{Ydr}$ (cf. section 5.3.1 and ch 6 discussion for details).

5.2.8.1. Implication for IRM indictors Composite Risk Management Process in the University.

As discussed earlier (cf. ch 2: 19 section 2.2. ch 3: 57 section 3.2), the risk management processes, which relate to the natural science paradigm, described risk management as being a field of objective as part of the risk management process (Nicholas & Steyn, 2008; Crouhy, Galai, & Mark,2006; Faisal, Banwet, & Shankar, 2006; Gilli & Kellezi, 2006; Rothstein, Huber& Gaskell, 2006; Fletcher, 2005; Cox, & Babayev, 2005; Slywotzky,& John 2005; Haimes, Kaplan & Lambert, 2002; Greenland, 2001). From this it became evident that the mathematics and statistical techniques employ quantified comparisons and are technically inclined in the risk management process. Although the mathematics and statistical discipline focuses more on structured

systems in relation risk management, the process however depends very much on beliefs, feelings and judgements [and] has a major influence on the tolerability or acceptance of risk (cf. ch. 3 section 3.3).

Nevertheless, the techniques used in this study, which formed part of the natural science paradigm, are more concerned write risk managing failures about social issues operating within a University, such as risk associated with pass rates, throughput rate, 3rd stream income, infrastructure etc.

Social scientists strongly oppose the view of natural scientists regarding management of risk and warn that ignoring sociological/social issues could, prove problematic, since the result of human error or lack of communication could be as disastrous as the result of technical failure (cf. Nicholas & Steyn, 2008 in ch. 2 section 2 and 3). With reference to the discussion in chapter 2 and Nicholas and Steyn (2008), this study considered the evaluation techniques of risk management as a collective construct in terms upside and downside risks, because when it comes to explaining an acceptable risk, judgement differs (cf. section 5.3 and in ch. 6).

Applying Nicholas and Steyn's (2008) views to the overall management of risk shows that risk analysis should not only consider the scientific processes of the natural (physical) sciences paradigm but is strongly advised from, although contributing to subjectivity, elements from the social sciences paradigm should also be taken into account. Thus, when trying to visualise the management of risk in the context of the two defined paradigms, it becomes apparent that the natural science paradigm and the social science paradigm should move closer together, with the overlap with information being the linking factor (cf. ch 6 for details).

5.3 CONCLUSION

This chapter presented and analysed the data. The results from the case as well as the literarture will been discussed in light of current literature in chapter 6. Lastly, the study proved that there is an inverse relation between upside risks and downside risks.

CHAPTER 6

DISCUSSION OF FINDINGS

6.1 INTRODUCTION

This chapter discusses applicability of business models (cf. section 2.4) that make up the IRM framework in a nonprofit organisation such as a university. In addition, it addresses the need for risk management policies, technical expertise and procedures in higher education**.** The chapter concludes with a proposition for a university – wide risk management framework, a section on predictability and measures of risk effects and challenges.

6.2 APPLICABILITY OF BUSINESS MODELS AND IRM FRAMEWORK IN A NONPROFIT ORGANISATION SUCH AS A UNIVERSITY

Following the data presentation (cf. ch 5: 90 section 5.2-5.3) and in relation to research question[54] 1 (cf ch section 1.1.6), this current section puts forth that the management of non-profit organisations is often ill understood because managers proceed from the wrong assumptions about how these organisations operate (cf. ch 1:19 section on Quality Management Conceptions). Based on this premise, the thesis suggests a framework of IRM of the non-profit form as a conglomerate of multiple models that demand a variety of different management approaches and styles (cf. ch 6 section 6.2.1); thus a *strategic-developmental dimension* that sees organisations as evolving systems encountering problems and opportunities that frequently involve fundamental dilemmas; and an

[54] How applicable is a business risk management framework in higher education institution (HEI)?

operative dimension that deals with the everyday functioning of organisations.

Both the *strategic-developmental and operative dimension* suggest that for a nonprofit organisation such as a University to institute institutional-wide risk management, it is important to assess the institutional system(s) (cf. section 6.3). In this regard, this section is intended to address the application of a University-wide risk management framework. Following the risk factors and the need to manage risk properly, it is argued that a University-wide risk framework is a collection of programs (manual and computer), documentation, policies, procedures and expertise to effectively manage the risks that impact on the objectives of the University (cf. data on likelihood and impact of risk) (also cf. ch 5: 90 sections 5.2-5.3).

From chapter two (section 2.2), Standard and Poor (2005) argued that the essence of the collection is to carry out logical risk information processing procedures, information storage, information retrieval, and display operations for one or more specified University operations. In fact, Nicholas (2004) in chapter two section 2.2 notes that it therefore becomes a business imperative for the risk framework to consist of one or many models. This therefore suggests that an institutional-wide framework should carry out established policy in a consistent and uniform manner. In the midst of other concerns, it should provide communication between operations of the University, within a function and between different functions of the University; create temporary and permanent records; provide a history of core business; and provide documents for notification and verification of risk status.

For a University to institute institutional-wide risk management, it is important to support the institutional system(s). Institutional systems are generally broad in scope, support several functions, and often impact the operation of the University. Systems that may impact only one department or operational area but require a high degree of interaction (interfacing or data exchange) with institutional systems can be implemented and operated most effectively in a shared data base environment to avoid duplication of processes. Such systems,

classified as institutional-wide risk should also be designated as institutional systems. Nicholas (2004) explains that this should be maintained, and operated as sub-systems or by – products/services of the primary institutional-wide[55] risk in order to avoid duplication of development effort, processing and inconsistencies in information. However, the data (cf. ch 5: 90 section 5.2-5.3) showed that the University did not have appropriate risk systems.

The research therefore maintains that with reference to risk, institutional systems are vital to normal on-going University operations; hence they require a highly reliable risk management framework. Thus, risk involving institutional systems must be implemented, maintained, and operated in accordance with the established standards of the University. Although, in chapter two, Nicholas (2004) argued for the integrity and continuity of institutional-wide risk, the data in chapter 5 section 5.2 suggested otherwise. The data suggested that in addition to Nicholas's (2004) assertion, the integrity and continuity of institutional-wide risk framework depend on key design factor maintainability, transferability, and auditability of risk (cf. ch 3: 57 sections 3.2-3.3).

Referring to the above, the research argues that (cf Measures of Risk) maintainability should be the ease with which changes can be made in the University to implement new policy with respect to risk. This is a key consideration in the design of institutional-wide risk framework as Standard and Poor (2005) support. Since institutional-wide risk management is not a once off process, continuity of operations of the institutional system depends heavily on transferability and auditability of risk, the ease with which the management of the University can be transferred from one employee to another. Transferability should be a function of standardisation of institutional-wide risk which should include but not limited to audit of documentation, risk design concepts, risk languages and risk control of the institution. Thus appropriate up-to-date

[55] For more on institutional-wide risk and silo approach see authors such as Liebenberg & Hoyt (2003) (for risk management & insurance review), Kleffner, Lee & McGannon (2003), Lam (2006).

logic and risk information flow diagrams and risk procedures must be maintained for all institutional systems in accordance with the requirements of all risk management policies, procedures and expertise. This eventually would reduce if not eliminate the challenge of risk and measures of risk.

6.2.1 New Managerialism or New Public Management in Education

Standard and Poor (2006) have argue that managerialism is a diffuse ideology which privileges the commercial models of organisation and management practice and insist that these should be transplanted to not-for-profit organisations such as institutions for higher education. IRM can be seen in that light, as a concept borrowed from the business world that can be used to manage nonprofit organisations such as a University. In fact, this could imply a new managerialism or new public management in education.

This new managerialism suggests what risk management can teach quality. From the review of literature (cf. ch 2: 19 Section 2.2), Stoney (2007) argues that a key aspect of risk management is the prioritisation of risks. Thus, risks are prioritised on the basis of their likely occurrence and effects (cf. ch 5: 90 sections 5.2-5.3). If quality departments take a similar approach and prioritise quality risks, then it is the expectation of this current study that many universities would find they are spending too much time and effort on traditional quality problems and too little on key new ones such as networking, e-business, brand image, etc.

Traditionally, Stoney (2007) argues that the focus of quality management is on solving the problem of too much inspection and waste. This is reduced by analysing faults and eliminating causes through improved product and process design. The aim of classic quality management was thus to reduce variation in routine situations, within a single stand-alone business/legal entity. This is still, in many organisations such as universities, of great importance. But new, fast-spreading types of

manufacturing have given rise to other pressing quality issues. Stoney (2007) outlines what the author describes as the characteristic features of modern manufacturing, which the author says support mass production in many industries. The characteristics are: flexible machines with low set-up costs; short production run.

The logic behind this form of manufacturing is increased flexibility, increased speed of reactions and, increased economies of scope and concentration on core competencies. It is spreading fast because, as in chapter 2 section 2.2, Stoney (2007) also comments, it is being driven by increasing competitive pressures, pressures for results from the money markets, and shrinkage of buying points in many markets leading to constant pressure on price, performance and innovation. The advantages may be clear, but so also are the dangers.

So, if quality departments working within universities adapt a risk management framework and prioritise their quality risks more carefully, then they may conclude that their framework is not concerned so much with gradually reducing routine variation within their own organisation (Stoney, 2007). Instead their new priority would be to ensure that both the organisation's internal and external relationships are such that mistakes, wherever possible, are reverted and if they appear, are rapidly resolved.

The most important causes of poor quality have changed (cf. ch 1:19 section on Quality Management Conceptions). They used to lie in poor processes and poor design. This is where new managerialism is applied**.** The quality department therefore first developed reliable measures of these and then devised tools and techniques to aid improvement. As argued by Stoney (2007), for many, the important causes of poor quality lie in weak internal and external relationships with key personnel and partners. Again the first stage, if quality is to reduce these risks, must be to develop adequate measures, and then the second will be to develop tools and techniques to improve them. But these areas are not easy to measure. The Japanese have been able to form long-lasting co-operative relationships both within their own organisations and

externally with key suppliers because their whole society after the Second World War encouraged this kind of behaviour amongst suppliers and customers, lifetime employment pacifying internal relationships, and financing which was not subject to the global place (Stoney, 2007). They did not need clear measures of relationship quality in order to manage these relationships, because society managed it for them. We need measures related to relationships used in an IRM framework. If they cannot be measured, then they are difficult to manage.

6.2.2 Relevance of Business Ethos in Non-profit Organisations

Several cautions are called for at the very beginning of an IRM framework (cf. ch 1:19 section 1.1.1-1.1.3). These are related to the review of literature on research question[56] 2 (cf. ch 1:19 section 1.1.6). First, several authors have written about the need to revisit the focus of non-profit management, and the major thrust of the argument developed in this thesis owes much to their insights about the role of non-profit organisations (see, for example, Stoney, 2007, King III Report, 2009). Likewise, organisational theory and normative management approaches inform much of what this study proposes (King III Report, 2009; Balbas, 2007; Kurre, 2007; Chavez-Demoulin & Embrechts, 2006; Saunders, Cornett, McGraw, & Anne, 2006; Brookryk, 2005; Krishnan, 2004; Casualty Actuarial Society CAS, 2003). Yet the study proceeds from the assumption that current management and organisational theories have not fully come to terms with a simple question: are non-profit organisations sufficiently distinct from both business firm and public agency as to require separate management frameworks and models and practices?

Trying to answer this seemingly simple question leads to other, equally challenging ones: is nonprofit management a variation of business management? Is it closer to public management and administration? Or do institutions in fact find that the management of non-

[56] How relevant is risk management framework in an HEI?

profit organisation is distinct from both, requiring frameworks and models that fit neither the corporation nor the public agency?

Of course as Stoney (2007) rightly puts it, these questions assume some agreement of what non-profit organisations are, and how to define them. Like all organisations, non-profit organisations vary much in terms of mission, size, mode of operation and impact, particularly in a cross-national sense. Some are closer to the model of a government agency; others may indeed resemble the business firm; and yet others may be little more than an informal network. Notwithstanding the variations, there is an emerging consensus among researchers in the field that non-profit organisations have the following core characteristics (King III Report, 2009; Stoney, 2007); *Organized*, i.e. possessing some institutional reality, which separates the organisation from; informal entities such as families, gatherings or movements; *Private*, i.e., institutionally separate from government, which sets the entity apart from the public sector; *Non-profit-distributing*, i.e., not returning any profits generated to owners or equivalents, which distinguishes non-profits from businesses; *Self-governing*, i.e., equipped to control their own activities; and *Voluntary*, i.e., being non-compulsory in nature and with some degree of voluntary input in either the agency's activities or management.

The above characteristics suggest moving towards a comprehensive management framework borrowed from the business sector. The non-profit management literature has generally not taken into account that non-profit organisations are an amalgam of different organisational components, representing different criteria. Fortunately, the business concept suggested by King III Report (2009) offers a useful step toward the development of management models that are more in tune with the realities of non-profit organisations. Among the key facets of their business framework applied to the non-profit is: a *holistic conception of risk management or IRM.*

An institutional risk management view of organisations is needed particularly in the non-profit field, where organisations are frequently part of larger public-private systems of service delivery. In such

systems where multiple criteria are in operation, information available to management is frequently incomplete, dated, and distorted. Thus, in addition to management under uncertainty, which is the result of incomplete information, we are dealing with organisations that involve different perceptions and projections of reality as well as different assessments and implications for different constituencies. This suggest and *IRM* framework that sees organisations as an evolving system encountering problems and opportunities that frequently involves fundamental dilemmas for management. This dimension views non-profit organisations as entities that change over time as they deal with the opportunities and constraints confronting them as part of a larger political economy. This also includes a *dimension* that deals with the everyday functioning of the organisation, such as administration and accounting, personnel and service-delivery. This is indeed the part that has been the focus of conventional non-profit management.

6.3 NEED FOR RISK MANAGEMENT TECHNICAL EXPERTISE, POLICIES AND PROCEDURES IN HIGHER EDUCATION

Both sections 6.2.1 and 6.2.2 discussed terms of argument about the applicability and relevance of business risk management in nonprofit organisations. The two sections suggest that there is need for risk management policies in a higher education quality management system especially due to the shortcomings of current quality management practices discussed in chapter 1 (cf. ch 1:19 section 1.1.3 quality management conceptions).

The essence of this section is to discuss the relevance and applicability of University-wide policies, procedures and technical expertise of risk. In so doing, it addresses research questions[57] one, two

[57] RQ1 How applicable is a business risk management model in higher education institutions (HEI)? RQ2 How do risk variables relate with each other? RQ3 How relevant is business risk management model in a higher education institution? RQ4 What predictive power does business risk management model have within higher education institutions (HEI) quality management framework? RQ5 What organisational-wide risk management framework is applicable in Higher Education?

and five. In every institution, there exists a culture and ways of risk being identified and subsequently measured (cf. ch. 5 section 5.2-5.3). Recent research and literature (Liebenberg & Hoyt, 2008; Standard & Poor, 2005, Nicholas, 2004) suggest that risk is defined in the institution's standard of measurement (cf. ch. 2 section 2.1). From this standpoint, this standard of measurement of risk should implicitly be crafted into two main areas based on the risk management policy. As a survey of literature (Liebenberg & Hoyt, 2003; Nicholas 2004; Hausken, 2002; Kunreuther, 2002; Major, 2002; Turban & Meredith, 1994) supports, these are embodied in (1) objectives of the institution (OBT) (2) mission statement (MS) (3) statement vision (SV) and (4) key success factors (KSFs). Judging from an IRM policy, and the institutions standard of measurement, it does suggest that it is not only important to clearly and adequately define the University's requirements which include the two mentioned above standards of institutional measure, but it is equally necessary to appoint a University-wide risk monitor with the requisite skills and knowledge of institutional wide risk. It can therefore be said that forming University teams (committees) is an important characteristic of institutional-wide risk management.

In addition, it is important to clearly define appropriate skills and roles and knowledge. From the University's standpoint, it is not clear even how members of committees were selected. It appears that, once an individual heads a position, it is assumed they have the technical know-how to undertake risk, hence inclusion in various committees. The research argues that this is an erroneous standard to undertaking risk and its measurements, since the lack of formal risk knowledge could lead to misapplication of risk in the form of its awareness, identification, prioritisation, mitigation, reporting and its control (cf. ch 5: 90 section 5.2-5.3). Thus, even if risk analysis need to be formed, it is imperative that any analysis is supported with technical knowledge.

The above normally relates to factors that matter most to the institution's strategic goals, which in this case is the standard of measurement. Thus, when using this framework, institutional risk

managers need to have a clear definition and a common understanding of what the institution means by those risks associated with the standard of measurement (cf. ch 2: 19 section 2.1 & 2.2). Hence, the framework assumes that risk concept and the goals of the higher education institution (s) need to be defined.

Contrary to the view of this research, the investigated University lacked these policies and procedures, which should have been crafted into the standard and measurement (cf. ch 5: 90 sections 5.2 & ch 7 section 7.2). It is imperative to note that here, the goals of institutional-risk management in any higher education institution are presented on a general level in its (a) mission statement (b) academic level in the programme objectives and (c) expected learning outcomes.

From the above, higher education's management of risk is linked to the effectiveness and efficiency of achieving its standard of measurement. Effectiveness is connected with the objectives of the course whereas efficiency is connected with the resources used in order to meet the objectives. In chapter 1 section 1.2, Standard and Poor (2006) explain that they are related in a sense because, to carry out risk management processes in an HEI, one is obligated to ascertain the risks of an institution in the form of the mission statement and as well the academic level in the programme objectives and expected learning outcomes as found in risk analysis. But the difference between effectiveness and efficiency lies in the processes of modeling and measuring risks which the research outlined in chapters 2 applied in chapter 5.

It is important to note therefore that in order to support University-wide risk goals from a framework, it is necessary to evaluate a comprehensive set of scenarios which correlate with the objectives of the institution (OBT), mission statement, statement vision (SV) coupled with key success factors (KSFs) and or key performance indicators (KPIs). Additionally, in all, but the simplest cases, decision-support requires that risk (uncertainty) be addressed; and because ORM frequently need's to address several outcomes of complex scenarios (such as the SV, OBT,

KSF and KPI among others), risks may be highly significant. Thus, these SV, OBT, KSF and KPI need to be reflected in the decision model by committee members, not only because, they may influence the decision, but also because they strongly influence the applicability and relevance of the institutional-wide risk management (IRM) and its framework in higher education. Another framework[58] as explained by Standard and Poor (2006) relates the above but gears it towards the institution's policies, infrastructure, and methodology (cf. ch. 2; Standard & Poors, 2006).

6.4 PROPOSITIONS FOR A UNIVERSITY-WIDE RISK MANAGEMENT FRAMEWORK

Against the background laid out above (cf. sections 6.2-6.3) and in relation to research question[59] 5 (cf. ch section 1.1.6 research questions), the framework for non-profit organisations is a conglomerate of multiple models or component parts that represents one possible IRM framework (cf. ch 2: 19 section 2.4 & ch 3: 57 section 3.2). Such a framework involves several crucial models (cf. ch 2: 19 section 2.4; ch 3: 57 section 3.2 and its application in ch 5: 90 section 5.2-5.3).

A critical first dimension is between an 'analystic' and 'conceptual' framework (cf. ch 2: 19 section 2.4.1 for details). An analystic IRM values predictability over improvisation, dwells on constraints rather than opportunities, borrows solutions rather than inventing them, defends past action rather than devising new ones, favours mathematical /statistical over goal flexibility, searches for 'final' solutions, and discourages contradictions and experiments (cf. ch 5: 90 section 5.2-5.3) (Nicholas, 2004). The challenge of non-profit management, then, is to balance the different, often contradictory elements that are the component parts of non-profit organisations (cf. ch 3: 57 section 3.2). How can this be

[58] Also see authors such as (Making sense of COSO's new framework for enterprise risk management)

[59] What institutional-wide risk management framework is applicable in an HEI quality management? cf. section 1.1.6 for research questions

done? The first instance, management has to locate and position the organisation in the complex push-and-pull of divergent models and underlying dilemmas and choices of an IRM framework. Following such a position analysis, management can ask: “should we be more analytic-like or conceptual”?

Few non-profit organisations are either analystic or conceptual. Instead, the current study suggests non-profit organisations should frequently use both. Behind this duality lies the notion that some of the multiple components of non-profit organisations tend to be more analystic - like, while others resemble conceptual. Whereas conceptual organisations represent the management styles of adhoracy, analystic comes closer to the models of mathematical and statistical models.

6.5 PREDICTABILITY AND MEASURES OF RISK: EFFECTS AND CHALLENGES

This section discusses a number of key challenges concerning the relevance and application of business risk management in the social context with regard to research questions[60] 3 and 4 (cf. ch 1:19 section 1.1.6). The challenges in relation to this research and its context are twofold: (a) the extensive reliance of social settings on subjective judgment (cf. ch 3: 57 sections 3.2-3.3), bearing in mind that risk analysis requires the development of guidance to make informed decisions and possibly the development of robust or reference prior distributions to minimise the reliance on judgment and (b) the treatment of human performance in quantitative risk analysis (cf. ch 3: 57 sections 3.2-3.3). All of these areas are seen as presenting interesting research challenges at the (1) interface between risk management, (2) the tools of risk management (such as mathematics and statistics) and (3) the context in which it is applied.

Recent studies (Embrechts et al., 2004; Nicholas, 2004) suggest that risk analysis addresses the most important components of a

[60] cf research questions

society, e.g. human health. Nicholas (2004) cautions that this process requires at various crucial cross-points, statistical inference based on human data. The literature (Embrechts et al., 2004; Raz & Michael, 2001) review in chapter 3 cautioned the use of appropriate statistical methods in risk analysis that did not impact on the researcher's knowledge and understanding of the methods used in risk analysis.

The above was well noted because, the authors (Embrechts et al., 2004; Raz & Michael, 2001) view of the use of appropriate statistical methods in risk analysis has been unduly limited for a long time. Possible reasons noted by Nicholas (2004) may have been (a) missing knowledge and know-how of statistical methods on the side of risk analyst (b) insufficient communication, too complex explanation and unawareness of the real world problems on the side of the statisticians (c) missing user-friendly and user guiding software to be used and understood by the risk analyst. Although, points (b) and (c) are a matter of concern to every risk analyst, it does not mean there are no readily available statistical and mathematical methods to proceed with in the case of HEI. For instance, chapter 5 the use of Bayesian analysis which is a statistical model but based on human judgement for decision-making (cf. chs. 2, 3 & 5). Moreover, in relation to point (c) the approach used by the researcher was to interlink the application of the software SPSS and the mathematics formula used.

Referring to these points above the researcher finds no serious challenge, but what is of concern is the technical knowledge required by other users in risk analysis. It becomes a difficult task if knowledge of the software is limited. Although, the software used was not specifically designed for risk analysis, however, it is it is recommended institutions use appropriate risk analysis software other than SPSS, the software used does give an objective sense of statistical indexes.

Meanwhile, many packages are rather simple and do not allow thorough statistical calculations, e.g. estimates of variances are often based on unjustified assumptions, like normal theory in the case of small sample sizes, and more complex analyses of uncertainty and the

assessment of model adequacy or model uncertainty and its influence on the risk estimates are prohibited.

Noting the growing trend of quantitative risk analysis in the business sector, the same cannot be said about an HEI. With reference to point (b) above, this presents a risk in an HEI as most institutions are undeveloped in the area of risk analysis in terms of computational statistics or reliable quantitative risk estimates. Thus, it is important to elaborate and exhibit important computational challenges, primarily for the components (b), above, which require the use of thorough statistical and solid computational methods. With reference to (b) the researcher addressed responses using the benchmark approach (cf. ch. 5) as a special sort of response curve fitting computational needs. Although many statistical software packages (e.g. SAS, SPSS, MATLAB, Monte Carlo simulation and fuzzy logic) can deal with response analysis, it would to use software that has been specifically developed for the purpose of deriving risk guidance values.

In particular, the Benchmark developed and application of Bayesian analysis by this research designed use by a non-specialist in modeling. The class of models to be used for response curves is unlimited however, the data sets may be small, but not to say very small. This may pose problems in model[61] selection, both for statistical analytic models and structural simulation models (cf. ch. 2 section 2.4 IRM modeling and tools). Due to limited knowledge in computational statistics, Epstein et al. (2005) in chapter 2 argue that users tend to restrict modeling to estimating probabilities through expert testimony which under a variety of circumstances may not be reliable and as such poses a challenge of markedly different expert views.

[61] Also see good approaches by Deutsch (2004) (for derivatives and internal models); Øksendal (2000) (for stochastic differential equations: an introduction with applications); Morgan (1996) (for *RiskMetrics – Technical Document);* Runggaldier & Zaccaria (2000) (for a stochastic control approach to risk management under restricted information); Holton (1997) (for subjective value at risk) and Ait Sahalia & Lo (2000) (for nonparametric risk management and implied risk aversion).

6.6 CONCLUSION

This chapter addressed the need for risk management policies, technical expertise and procedures in higher education. In so doing it addressed the five research questions noting that while literature concentrated on questions 1, 2 and 5, data presentation (cf. ch 5: 90) addressed research questions 3 and 4. The chapter concluded with a proposition for a university –wide risk management framework including a section on risk and measures of risk; effects and challenges.

CHAPTER 7

SUMMARY CONCLUSIONS AND RECOMMENDATIONS

7.0 INTRODUCTION

Chapter 7 discusses a summary of the main ideas. It continues with a summary of findings, conclusions and recommendations for further study.

7.1 SUMMARY OF MAIN IDEAS

The first chapter explained the background/context, problem and rationale for carrying out the study. In chapter 1, it was argued that IRM is a framework that provides an approach to enhance quality, but so far this has only been applied in for-profit business organisations and not in not-for profit organinsations such as higher education institutions (HEIs) (Stoney 2007; King III Report, 2009). As a result, the current study emanated from the growing concern of risk and risk management both in business and not for-profit organisations to investigate how applicable and relevant an IRM framework would be in not-for profit organisation such as a University.

Chapter two elaborated on institutional risk management. The chapter addressed numerous definitions of risk and risk management. It was clear that there was no one definition, but rather a contextual one. Another important issue considered was risk management in the higher education sector; this led to institutional-wide risk management (IRM) as well as the characteristics of institutional-wide risk management. The next section in the chapter was on the relevance for institutional-wide risk, its applicability and management in higher education. The chapter concluded with a review of literature on the measures, models and tools used in IRM from both subjective and objective probability perspectives**.** There were several models identified as constituting an IRM framework. The discussion on risk measuring and

modelling (cf. ch 2: 19 section 2.4) argued that the process is referred to as the methods by which risk and performance measures are determined.

Chapter three addressed the quality of an IRM framework and it addressed modeling subjective probability. The last two sections dealt with human error and human performance as well as measurability of human phenomena.

Chapter four covered the methodology and approach to research. It involved a discussion on the orientation of the research, which looked at a positivist paradigm, interpretivist paradigm and mixed methods. The next section covered the research design. This included addressing the case study design, the case, case selection, sampling within the case and structure of the investigation. The data collection method section then followed. This section addressed instrumentation, questionnaire, interviews, document analysis, triangulation of methods and reliability analysis of instrument. The other three sections addressed were data analysis, challenges of the research and research rigour.

Chapter 5 was presentation and analysis of data. This chapter explained and outlined the research results in relation to research question 3, with literature cross-validation in chapter 6. Lastly, the study proved that there was an inverse relationship between upside risks and downside risks (cf. ch 5: 90 section 5.3.8).

Chapter six discussed the results. That is findings of applicability of business models that form IRM framework in a nonprofit orgainsiation such in a university. In addition, it addressed the need for risk management policies, technical expertise and procedures in higher education. This chapter concluded with a proposition for a university – wide risk management framework as well as a section on predictability and measures of risk; effects and challenges.

Chapter 7 discussed a summary of the main ideas. It continued with a summary of findings, conclusion and recommendation for further study

7.2 SUMMARY OF MAIN FINDINGS

From carrying out this study, the researcher has drawn summaries under seven areas of institutional-risk management. Noting that institutional-wide risk management framework embodies various models as seen in chapter five (cf. ch 2: 19 section 2.4 & ch 5: 90 sections 5.2-5.3), the findings that emanated are as summarised.

Risk awareness: Risk awareness is not just something for corporations or organisations, but for any activity whether short or long term. The benefits and opportunities should be viewed not just in the context of the activity itself, but in relation to the many and varied stakeholders who may be affected. By meeting the various component parts of the organisation, albeit in different ways, organisations will be in a position to report that they are in compliance. Against this backdrop, with reference to the interview data, disaggregated together with the composites of risk awareness in the University, there was one area of concern that the University lacked institutional-wide risk awareness. The University does not ensure that an awareness of the institution's key risks is cascaded downward, upward or horizontally through out the university employees.

Risk identification: However, from the various data in this subsection, the main area of concern to the University is that (1) the University does not identify and prioritise its risks to a sufficient standard (2) and that the institution’s key risks was not linked and prioritized to its strategic objectives.

Risk mitigation: Risk mitigation is the process of selecting and implementing measures to modify the risk. Risk mitigation includes as its major element, risk control but extends further to, for example, risk avoidance, risk transfer, risk financing.

The main findings revealed that (1) the University has no adequate control mechanisms to mitigate risk (2) the University does not take adequate account of the key risks identified by key stakeholders and thirdly 3) the University’s overall approach to risk management, as

assessed for one-academic year is not adequate for its strategic objectives. Notwithstanding the concerns raised above, there were two positive elements: (1) the responsibility for the oversight of individual key risks has been assigned to appropriate managers (2) the issues arising from audits are brought to the attention of the executive management team as appropriate. The mathematical model developed in conjunction with other sections showed that risk mitigation could be broken down into two components: (1) risk elimination and (2) risk reduction. The research argues that a risk elimination process should be aggressive and proactive for top priority risks. On the other hand, early intervention could the degree of occurrence or lessen the impact.

Risk monitoring and reporting: Effective IRM requires a reporting and review structure to ensure that risks are effectively identified and assessed and that appropriate controls and responses are in place. Regular audits of policy and standards compliance should be carried out and standards performance reviewed to identify opportunities for improvement. It should be remembered that organisations are dynamic and operate in dynamic environments. Changes in the organisation and the environment in which it operates must be identified and appropriate modifications made to systems. The monitoring process should provide assurance that there are appropriate controls in place for the organisation's activities and that the procedures are understood and followed. Any monitoring and review process should also determine whether: the measures adopted result in what was intended • the procedures adopted and information gathered for undertaking the assessment was appropriate • improved knowledge will make better decisions and identify what lessons can be learned for future assessments and management of risks.

However, the findings of this section were conclusive on three points: (1) the University does not have overall reporting processes designated to risk officers on risk to make the required annual audit (2) the University does not have formal risk management monitoring and reporting systems (3) the University does not have sufficient resources in relation to risk management and its development in the University.

Contrary to the above is one positive fact that the external audits (if conducted) as part of statutory regulation within the University are brought to the authorities of the University.

Risk planning and operation: Creating an IRM plan is a critical step in any organisation, as it helps to reduce the likelihood of risk occurring. Regardless of the type of risk, an organisation will be able to use an IRM plan to put in place processes and procedures for reducing the likelihood of risk occurring, thereby helping to deliver organisational success. The findings were that the University needed risk plan in order to: (1) Identify preventative actions to the risk occurring (2) List contingent actions to reduce the impact, should the risk occur (3) Schedule these actions within an acceptable timeframe.

Findings of the likelihood of occurrence of risk: The main findings of the section included: (1) once in an academic year there is the likelihood of not meeting the target of 3rd stream income (2) With regard to the likelihood of not meeting the target in pass rates for students in the institution, a similar view was highlighted (3) poor service culture is a major challenge that impact on the university's sustainability which impacts on its reputation (4) The institution is not likely to meet the target set in terms of teaching and academic staff qualification appropriated by the institution in an academic year.

Findings of impact of occurrence of risks: The findings of this section revealed that: (1) The impact of occurrence of risk associated with 3rd stream income typically was within once a year (2) An almost similar trend was revealed in relation to the impact of occurrence of risk associated with not meeting percentage of throughput targets (3) In the case of the impact of occurrence of risk associated with academic staff in university, the impact of the risk of not meeting the target of academic staff in research was quarterly (4) the impact of occurrence of risk associated with below target of allocation of infrastructure was within the neighborhood of a quarterly basis, may can equally occur in an academic year (5) A composite result of the risk of impact of the various indexes revealed that the risk impact of occurrence of risk of the university was typically once a year (6) Same as composite impact the composite

output of the likelihood of occurrence of various risks is unlikely- thus could happen but rarely (typically once a year).

Mathematical treatment of risk and the findings: With reference to the variables investigated (cf. mathematical treatment of risk), the main findings in relation to either controlling the likelihood or the impact of occurrence of risk was that to have a brighter risk reward, in all[62] cases, it was important to control the likelihood of occurrence of risks as compared with its impact so as to have a direct affect on the entire University.

7.3 CONCLUSIONS

Using measures of dispersion and Bayesian model together with Nicholas's risk model, the conclusion supports and confirms that there is a direct relationship between risk factor, its likelihood and impact, under constant conditions of the Institution (standard of measurements). The risk measurement is critical and affects all major issues in University (pass rate, throughput, staffing infrastructure etc). However, there is no general method to measure or model the degree of risk of the University. On the contrary, there are alternative models in business that are applicable to an HEI most importantly, the use of one or mainly more depends on the specific (a) standard of measurement (b) time the University has to deal with an IRM framework.

This research applied subjective and mathematical models concerning risk measures in the context of an HEI modeled from business setting. Due to the relevance of applicability, the researcher did not intend to exhaust all models that made up the IRM framework, but provided the HEI with a general view about the current risk measures and modeling approaches (cf. ch 2: 19 section 2.4). Thus, the researcher concludes that the measures of risk would merit the University's attention for various reasons: Firstly, as found in literature, application of risk measures should be related to the current legislative framework that affects an HEI. Secondly, they (mathematical models) are far less known than more

[62] but one (academic staff active in research)

classical risk measures in HEI. Thirdly, they present many open and interesting problems that may be addressed by other researchers interested in these issues, and fourthly, they may be applied in any HEI problem as well as for every kind of risk (pass rate, through put rate, infrastructural risk etc).

The measurement of risk levels is a major topic in business (Mathematical Finance). In an HEI it can be related to major classical issues as shown in chapter six (cf. ch 2: 19 section 2.4 & ch 6 section 6.3). In the past though, it has been addressed by drawing on different models, all of them reflecting a complex[63] mathematical development.

7.4 RECOMMENDATIONS

The recommendations are divided into two: For practice of quality management in an institution of higher learning; and further research on risk and quality management.

7.4.1 For Practice of Quality Management in an HEI

It is recommended that periodic surveys be conducted on the five IRM variables (cf. sections section 5.2-5.3) to see how change occurs over time, suggesting that management can set targets for both upside and downside indicators of risk management (cf. section 5.3.8). This can also be instituted as a policy from government to all HEIs. Use of Morte Carlo simulation to test the risk results and fuzzy logic to build and keep results for future use is recommended. Ensure that University staffs have clear

[63] The researcher has concluded and summarised some major findings, but for obvious reasons questions such as applicability of other models have not been addressed here. Thus many theoretical and practical problems are still open. Some of which are: Functional Analysis, Complex analysis, Numerical analysis, Measure and Probability Theory, Ordinary differential equations, Partial differential equations, Delay differential equations, Stochastic differential equations, Mathematical Programming and other mathematical fields that play a crucial role, and they would go on playing a crucial role in future research in risk management.

accountability for both the ownership and cost of risk and the tools to effectively reduce risk. Incorporate institutional-wide risk management in the Council's decision-making, business planning and performance management processes.

7.4.2. For Further Research

Measures of Risk: Though the research focused on the measures of dispersion and Bayesian models as risk measures (cf. ch 2: 19 section 2.4), it is not difficult to extend the ideas so as to show that other dispersion measures (the absolute deviation, for instance) also respect the classical mathematical relation that there is a direct relationship between risk, its likelihood and impact, which can also be used in order to measure risk levels. An alternative idea is to consider that risk level is just a real number, suggesting that the argument is not a random variable, but a stochastic process (consistent change of events). The research does not consider the future risk, which arguably is a function of time, and does not apply the principle underlying a stochastic process (under stochastic differential equations), because this was not the intended approach. It is strongly recommended that the whole stochastic calculus of risk be tried and tested with HEI risk variables.

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APPENDICES

APPENDIX A

Faculty of Education

School of Initial Teacher Education

28 Commissioner Street, East London,
Phone: East London: 043704 7020/7076

Dear Sir/Madam

RE: Applicability and Relevance of Risk Management Model in Higher Education Quality Management

My name is Anass Bayaga. I am a PhD student in the faculty of Education, University of Fort Hare. In fulfilment of the requirements of the said degree, I intend to conduct a study on **Applicability and Relevance of Risk Management Model in Higher Education Quality Management'**. The study involves investigation through document analysis, interviews with people in various leadership and management positions in the university and use of questionnaires.

I request that you be one of the respondents. In this connection, I would appreciate it if you would kindly complete the attached questionnaire. In due course I would like to conduct follow-up interviews on themes in the questionnaire. Interview will be arranged at a time convenient to you.

Please be assured that you will remain anonymous and responses will be treated with strictest degree of confidentiality. I would therefore appreciate it if you could respond as frankly and as candidly as possible. Attached please find the questionnaire and a clearance letter from the University. Your cooperation and assistance is highly appreciated.

Please send the completed questionnaire to email address: abayaga@ufh.ac.za

Yours Sincerely

Anass Bayaga

APPENDIX B

QUESTIONNAIRE

Applicability and Relevance of Risk Management Model in Higher Education Quality Management

2009

In recent years, both internal and external factors have fueled a heightened interest in organisational-wide risk management (ORM). The Business industry and government regulatory bodies, as well as stakeholders, have begun to scrutinise institution's risk-management policies, procedures and practices. The question then is how does this affect and apply to Higher Education Institutions (HEI) both from subjective and objective probability theories?

This research aims to provide information on, inter alia, the **Applicability and Relevance of Risk Management Model in Higher Education Quality Management**

The questionnaire is **anonymous** and is undertaken to inform policy decisions and for academic purpose.

Please answer ALL the questions as honestly as possible.

There are 7 Sections:

BACKGROUND	
INFORMATION:	Grade and Committee
SECTION A:	Risk awareness
SECTION B:	Identification and prioritisation of risks
SECTION C:	Risk mitigation
SECTION D:	Risk management reporting and monitoring
SECTION E:	Embedding risk management into planning and operation processes
SECTION F:	Risk quantification process

Background Information

Perommes grade
Please highlight or tick the number (s) which characterises your perommes grade
1, 2, 3, 4, 5, 6, 7, 8, 9, 10
11, 12, 13, 14, 15, 16, 17, 18, 19

Committee (s)
Please highlight or tick the number of committee (s) of Senate in which you serve
1. Executive committee of senate (SENEX) 2. Prospectus 3. Enrolment Management 4. Rules and Regulation 5. Senate Discretionary Exemption 6. Teaching and Learning 7. Time Table 8. Library 9. Graduation Committee Institutional 10. Institutional Quality/Risk Assurance 11. Central Academic Planning 12. Academic Promotions and Professional 13. Research and Development 14. Housing 15. Management and SRC 16. IT Management 17. Support Services Quality Assurance 18. Skills Development 19. Employment Equity 20. Financial Aid Committee 21. Any other (specify) …….. 22. I Do Not Know

SECTION A: Risk Awareness

Please **highlight or tick** the number which characterises the situation in your University.

Q1 Who is responsible for identifying risks facing your organisation

Circle that which apply

Executive Committee of Senate (SENEX)	1
Prospectus Committee	2
Enrolment Management Committee	3
Rules and Regulation Committee	4
Discretionary Exemption Committee	5
Senate Teaching and Learning Committee	6
Time Table Committee	7
Library Committee	8
Graduation Committee	9
Institutional Quality/Risk Assurance Committee	10
Central Academic Planning Committee	11
Academic Promotions and Professional Committee	12
Research and Development Committee	13
Management and SRC Committee	14
IT Management Committee	15
Support Services Quality Assurance Committee	16
Skills Development Committee	17
Financial Aid Committee	18
Housing	19
I Do Not Know	20

Please **highlight or tick** the number which characterises the situation in your University.

Q2 The university has a risk treatment (action) plan

Strongly agree	Agree	Unsure	Disagree	Strongly disagree
5	4	3	2	1

Q3. The responsibility for risk management is understood and documented throughout the university

Strongly agree	Agree	Unsure	Disagree	Strongly disagree
5	4	3	2	1

Q4. The university recognises the importance of organisational-wide risk management for the achievement of its objectives

Strongly agree	Agree	Unsure	Disagree	Strongly disagree
5	4	3	2	1

Q5. The university recognises the need for risk management skills

Strongly agree	Agree	Unsure	Disagree	Strongly disagree
5	4	3	2	1

SECTION B: Identification and prioritisation of risks

This section of the questionnaire deals with identification and prioritisation of risks.

Please **highlight or tick** the number which characterises the situation in your University.

6. Overall, the institution has identified its risks to a sufficient standard

Strongly agree	Agree	Unsure	Disagree	Strongly disagree
5	4	3	2	1

Q7. Overall, the institution has prioritised its risks to a sufficient standard

Strongly agree	Agree	Unsure	Disagree	Strongly disagree
5	4	3	2	1

Q8. The institution's key risks are linked to its strategic objectives

Strongly agree	Agree	Unsure	Disagree	Strongly disagree
5	4	3	2	1

Q9. The awareness of the institution's key risks is cascaded downward, upward or horizontally through out the university

Strongly agree	Agree	Unsure	Disagree	Strongly disagree
5	4	3	2	1

SECTION C Risk Mitigation

This section of the questionnaire deals with mitigation of risks.

Please **highlight or tick** the number which characterises the situation in your University.

Q10. The institution has adequate control mechanisms to mitigate risk

Strongly agree	Agree	Unsure	Disagree	Strongly disagree
5	4	3	2	1

Q11. Responsibility for the oversight of individual key risks has been assigned to appropriate managers

Strongly agree	Agree	Unsure	Disagree	Strongly disagree
5	4	3	2	1

Q12. The institution takes adequate account of the key risks identified by key stakeholders (e.g. students, the DOE, the funding bodies and research councils on which the institution relies)

Strongly agree	Agree	Unsure	Disagree	Strongly disagree
5	4	3	2	1

Q13 The institution's overall approach to risk management, as assessed for one-academic year is adequate for its strategic objectives

Strongly agree	Agree	Unsure	Disagree	Strongly disagree
5	4	3	2	1

Q14 The issues arising from audits are brought to the attention of the executive management team as appropriate

Strongly agree	Agree	Unsure	Disagree	Strongly disagree
5	4	3	2	1

SECTION D Risk management reporting and monitoring

This section of the questionnaire deals with reporting and monitoring of risks.

Please **highlight or tick** the number which characterises the situation in your University.

Q15. Overall reporting processes give designated officers sufficient information on risk to make required annual audit

Strongly agree	Agree	Unsure	Disagree	Strongly disagree
5	4	3	2	1

Q16. Formal risk management monitoring and reporting arrangements have been put in place for the executive management team/audit committee

Strongly agree	Agree	Unsure	Disagree	Strongly disagree
5	4	3	2	1

Q17. The university applies sufficient resources to risk management and its development

Strongly agree	Agree	Unsure	Disagree	Strongly disagree
5	4	3	2	1

Q18 There are early warning indicators for all the key risks reported to management within regular management information reports

Strongly agree	Agree	Unsure	Disagree	Strongly disagree
5	4	3	2	1

Q19 External auditors conduct audits as part of statutory regulation

Strongly agree	Agree	Unsure	Disagree	Strongly disagree
5	4	3	2	1

SECTION E: Embedding risk management into planning and operation

This section of the questionnaire deals with embedding risk management into planning and operation of risks.

Please **highlight or tick** the number which characteries the situation in your University.

Q20. Overall, the institution embedded risk management into its planning and operational processes to a sufficient extent

Strongly agree	Agree	Unsure	Disagree	Strongly disagree
5	4	3	2	1

Q21. There are mitigating controls for the key risks which are fully embedded into the institution's business processes

Strongly agree	Agree	Unsure	Disagree	Strongly disagree
5	4	3	2	1

Q22. The institutional policy documents adequately deal with risk management issues

Strongly agree	Agree	Unsure	Disagree	Strongly disagree
5	4	3	2	1

Q23. linternal auditors conduct audits as part of statutory regulation

Strongly agree	Agree	Unsure	Disagree	Strongly disagree
5	4	3	2	1

Q24. The institution has adequately considered both financial and non-financial risks(e.g., reputation, fraud, health and safety, business continuity) in its strategic objectives

Strongly agree	Agree	Unsure	Disagree	Strongly disagree
5	4	3	2	1

SECTION F: Risk quantification process

This section of the questionnaire deals with risk quantification

Please **highlight or tick** the number which best describes the situation with regard to likelihood of occurrence of risk in statements 25.1 to 25.6

Key

Rare	Unlikely	Possible	Likely	Almost Certain
Remote possibility (once every 3 years or more) **1**	Could happen but rare (typically once a year) **2**	Could happen occasionally (on average quarterly) **3**	Could happen often (on average once a month or more) **4**	Could happen frequently (once a week or more) **5**

Q25.1 What likelihood of occurrence of risk is associated with below target of 3rd stream income **1 2 3 4 5**

Q25.2 What likelihood of occurrence of risk is associated with below target in pass rates for all student groups of the institution **1 2 3 4 5**

Q25.3 What likelihood of occurrence of risk is associated with percentage throughput targets met in the institution **1 2 3 4 5**

Q25.4 The likelihood of occurrence of risk associated with below target of teaching and academic staff active in research is **1 2 3 4 5**

Q25.5 The likelihood of occurrence of risk associated with below target of allocation of infrastructure (e.g classrooms, labs, residences etc) is **1 2 3 4 5**

Q25.6 The likelihood of occurrence of risk associated with below target of teaching staff with Masters and or Doctorates is **1 2 3 4 5**

Impact of occurrence of risk should it occur

Please **highlight or tick** the number which best describes the situation with regard to impact of occurrence of risk in statements 26.1 to 26.6

insignificant	**Minor**	**Moderate**	**Significant**	**Major**
Remote possibility (once every 1 years or more) **1**	Could happen but rare (typically once a year) **2**	Could happen occasionally (on average quarterly) **3**	Could happen often (on average once a month or more) **4**	Could happen frequently (once a week or more) **5**

Q26.1 What impact of occurrence of risk is associated with below target of 3rd stream income **1 2 3 4 5**

Q26.2 What impact of occurance of risk is associated with below target in pass rates for all student groups of the institution **1 2 3 4 5**

Q26.3 What impact of occurrence of risk is associated with percentage throughput targets met in the institution **1 2 3 4 5**

Q26.4 The impact of occurrence of **1 2 3 4 5**
risk associated with below target of teaching and academic staff active in research is

Q26.5 The impact of occurrence of risk associated **1 2 3 4 5**
with below target of allocation of infrastructure
(e.g classrooms, labs, residences etc) is

Q26.6 The impact of occurrence of **1 2 3 4 5**
risk associated with below target of teaching staff with Masters and or Doctorates is

Thanks for your cooperation

For inquiries, please contact A. Bayaga Faculty of Education,
Email: abayaga@ufh.ac.za

APPENDIX C

Interview

Applicability and Relevance of Risk Management Model in Higher Education Quality Management

2009

In recent years, both internal and external factors have fueled a heightened interest in organisational-wide risk management (ORM). The Business industry and government regulatory bodies, as well as stakeholders, have begun to scrutinise institution's risk-management policies, procedures and practices.

The question then is how does this affect and apply to Higher Education Institutions (HEI) both from subjective and objective probability theories? This research aims to provide information on, inter alia, the **Applicability and Relevance of Risk Management Model in Higher Education Quality Management**. The interview is **anonymous** and undertaken to inform policy decisions and for academic purpose.

Please answer ALL the questions as honestly as possible.

Q1 Mention some measures taken by the institution's management to address the risks.

Q2 How are high-level risk factors reflected in the institution's strategic objective?

Q3 What risks are associated with financial sustainability of the institution in relation to ?

a)**FINANCIAL LIQUIDITY** • Sufficient monthly cash flow • % student debt recovered by Dec (By March)	b)**MAXIMISE INCOME FROM SUBSIDY AND FEE** • % compliance with enrolment plan • Fee income from students
c)**DIVERSIFY REVENUE BASE** • % of 3rd stream income vs total budget • Capital raised • % student fees funded through bursaries	d)**OPTIMISE EXPENDITURE** • % budget compliance

Q4 What risks are associated with the institution as first choice in relation to?

a) PREFERRED INSTITUTION • Student satisfaction index	**b) COMMUNITY ENGAGEMENT** No and value of community engagement partnerships
c) INSTITUTIONAL EQUITY PROFILE • Achieve internal equity targets: staff • Achieve internal composition equity targets: students • % differential in pass rates for all student groups	

Q5What risks are associated with the institution in relation to (a) teaching, (b) research and (c) community engagement excellence ?

Q6What risks is associated with the institution becoming a performance driven organisation in relation to?

a) **ENHANCING TEACHING AND RESEARCH SKILLS** • % teaching staff with Masters, Doctorates • % teaching and academic staff with a PG teaching Qualification • % teaching and academic staff with portfolio	b) **MOTIVATED STAFF** • % staff turnover • Level of employee satisfaction

a) Improving throughput and retention • % throughput targets met • % retention targets met	**b) Improving programme quality** • Number of programme quality reviews • No of modules undergoing internal review • Staff: student FTE ratio	c)**Programme innovation** • No of new programmes/programme areas developed • Grounding programme developed for implementation • No of new programmes registered
d)**Research excellence** • % teaching and academic staff active in research • Subsidised research output	**e)Infrastructure availability and functionality** • % availability of online system • % of allocation for infrastructure spent (classrooms, labs, residences etc)	**f) Increasing capacity and quality of support system** • % achievement of support service: faculty service level agreements (SLAs)

Thanks for your cooperation

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Appendix C1

Table 5.11: What likelihood of occurrence of risk is associated with below target of 3rd stream income?

Responses	Frequency	Percent
Rare- Remote possibility (once every 3 years or more)	2	3.1
Unlikely- Could happen but rare (typically once a year)	52	81.3
Possible -Could happen occasionally (on average quarterly)	4	6.3
Likely - Could happen often (on average once a month or more)	4	6.3
Almost Certain- Could happen frequently (once a week or more)	2	3.1
Total	64	100.0

Appendix C2

Table 5.12: What likelihood of occurrence of risk is associated with below target in pass rates for all students?

	Frequency	Percent (%)
Rare- Remote possibility (once every 3 years or more)	1	1.6
Unlikely- Could happen but rare (typically once a year)	45	70.3
Possible -Could happen occasionally (on average quarterly)	11	17.2
Likely - Could happen often (on average once a month or more)	4	6.3
Almost Certain- Could happen frequently (once a week or more)	3	3.1
Total	64	100.0

Appendix C3

Table : 5.25: Observed and expected count of count of pass rates

What impact of occurrence of risk is associated with below target in pass rates for all student groups of the institution	What likelihood of occurrence of risk is associated with below target in pass rates for all student groups of the institution	Observed		Expected	
		Count	%	Count	%
Insignificant -Remote possibility (once every 3 years)	Rare- Remote possibility (once every 3 years or more)	1	1.6%	.031	.0%
	Unlikely- Could happen but rare (typically once a year)	1	1.6%	1.406	2.2%
	Possible -Could happen occasionally (on average quarterly)	0	.0%	.344	.5%
	Likely - Could happen often (on average once a month or more)	0	.0%	.156	.2%
	Almost Certain- Could happen frequently (once a week or more)	0	.0%	.062	.1%
Minor- Could happen but rare (typically once a year)	Rare- Remote possibility (once every 3 years or more)	0	.0%	**.450**	1.1%
	Unlikely- Could happen but rare (typically once a year)	34	53.1%	**.300**	48.3%
	Possible -Could happen occasionally (on average quarterly)	6	9.4%	**.250**	11.8%

	Likely - Could happen often (on average once a month or more)	2	3.1%	3.437	5.4%
	Almost Certain- Could happen frequently (once a week or more)	2	3.1%	1.375	2.1%
	Rare- Remote possibility (once every 3 years or more)	0	.0%	.219	.3%
	Unlikely- Could happen but rare (typically once a year)	10	15.6%	9.844	15.4%
	Possible -Could happen occasionally (on average quarterly)	3	4.7%	2.406	3.8%
	Likely - Could happen often (on average once a month or more)	1	1.6%	1.094	1.7%
	Almost Certain- Could happen frequently (once a week or more)	0	.0%	.437	.7%
Significant- Could happen often (on average once a month)	Rare- Remote possibility (once every 3 years or more)	0	.0%	.047	.1%
	Unlikely- Could happen but rare (typically once a year)	0	.0%	2.109	3.3%
	Possible -Could happen occasionally (on average quarterly)	1	1.6%	.516	.8%
	Likely - Could happen often (on average once a month or more)	2	3.1%	.234	.4%
	Almost Certain- Could happen frequently (once a week or more)	0	.0%	.094	.1%
Major- Could happen frequently (once a	Rare- Remote possibility (once	0	.0%	.016	.0%

week or more)	every 3 years or more)				
	Unlikely- Could happen but rare (typically once a year)	0	.0%	.703	1.1%
	Possible -Could happen occasionally (on average quarterly)	1	1.6%	.172	.3%
	Likely - Could happen often (on average once a month or more)	0	.0%	.078	.1%
	Almost Certain- Could happen frequently (once a week or more)	0	.0%	.031	.0%

APPENDIX D

Transcript A

Researcher :

Thank you for affording me this opportunity to have this interview with you. The interview is in relation with my Phd work. It is a follow-up of my data collection which I did send you in terms of my questionnaire. The study is on the analysis of risk management model in higher education quality management. So basically what I am trying to do is use business approach in managing risk in institutions of higher education. How would it be used in institutions of higher education.

Researcher

As part of management in the institution, what is your perspective how is your perspective on institutional risk management?

[64]Respondent 1(George)

I think I will look at the components that dealt with former point of view and one of them is capital and human growth, but I think the institution has come to understand that it is a risk factor, that if they are not paying for the level of skills, particularly for academics, that they might loose them. For instance with accounting, they have come up with retention scale because people who have studied accounting are offered better jobs somewhere else. That is risk that they know. The other risk for this university is the true put range. The student true put because the university does have a good intake, the risk is the capacity whether they have enough capacity to ensure that they take these students through the system. The other risk is financial sustainability, where I think that we are affected by so many things like the IT system not being up to date and the student records not being up to date so there has been a backlog in terms of keeping record such that you can claim and the university will get what it deserves. That has kind of opened some gap into the finances. I think

[64] Respondent 1 is George, while Respondent 2 is Lin (the names are pseudonyms)

the other risk that they aware of is human resources in terms of the ratio between academics and administrators that according to the Department of Education that the university is not in the right path, the ratio is 1 to 3, but I think as for now the university is the other way around, 2 to 1. There are more administrators than academics. There is three academics per 1administrator. But currently it is 1 academic to 2 administrators. We are more administrators than academics.

Researcher:

Normally what are some of the measures that the institution or management uses to address these risk.

Respondent-George:

I think the internal audit and the contributions. I also think that the incokos (discussions) that they used to have which are not necessarily addressing the risk but are looking at the way forward for the university and in so doing in that process identifies the risk that the university is taking and as well as how to overcome some of the risk. I will say the measure that they use at this stage i don't see it as being effective per se but rather as being assessing the status quo of the university.

Researcher:

As part of management can you say whether the university has a format in addressing risk?

Respondent-George:

They do. I have attended a meeting where there was an external consultant. It was twice, the first one was late last year and the other one was earlier which I was not part of it. The university was identifying the risk themselves and it was followed up by someone coming to address us and for us to do some calculations as to where are the red flags in terms of our institutions.

Researcher:

Do they include the risk that you mentioned earlier on or they are exclusive of those risks?

Respondent:

They did and also mentioned the multi compass model that we found ourselves in and what they were interested in was the human capital, the students and the culture of the university. Taking into consideration the history of the university as to how we can then embedd the emerging culture of a multi compass model verses the old Fort Hare. *Researcher*: How are they coping with that? That was also identified as risk. Yes I would say all the risks were identified and the stakeholders which is the management of the university had an opportunity to rate the level of risk.

Researcher:

Would you be able to tell me which was the riskiest place.

Respondent:

I cannot remember that, but I can tell you that the human capital was one of the highest Sometimes when it comes to rating risk is that some areas that people may find issue with or assume as areas of concern are rated very low when it comes to risk.

Researcher:

These high risk factors that you have mentioned, are they normally reflected in your strategic objectives ?

Respondent:

Well I think that the university has come up with a very good strategic plan (SP) which is called SP 2000 to the centenary 2016. SP means strategic

plan. I think that there were 5 or 7 key areas that we identified that the multi compass model itself and the culture of the university and the human capital and the student lives. But in that strategic plan, the key 8 areas that were identified are the areas that, when we looked at risk, the risk that were identified were embedded within the strategic goals of the university.

Researcher:

What risk are normally associated with when it comes to financial sustainability, here I am referring to the percentage of students debt recovery.

Respondent:

That is a huge risk because when you look at financial sustainability, two-thirds of the university income comes from the student fees. It means that if the students are not paying their fees, it means that the university is at risk of being indebted.

Researcher:

Does the institution have measures to mitigate this?

Respondent

Yes there are measures mitigated for recovering the debt. But I am not sure whether that is working because some of the measures were not to release the students' results. But what would happen is that, the students would owe, before they register the following year they have to pay all their previous accounts. So what that means is that the university is losing money the whole year and then the students will pay the debt the have accumulated the previous year the following year. Then in that year they still use the university's resources without being paid except for the MIP of R2 000.00. The other method is for people who have to graduate, they are not allowed to graduate till such time they finalise their accounts. That is how the university recovers the funds.

Researcher:

What risk are normally associated with when it comes to percentage compliance with enrolment plan ?

Respondent:

The risk was marketing, not being exposed enough as a university and how the faculties were not working hand in hand with the marketing department. And it was just accidental that we met the target, there was no rigorous plan around meeting the target. It was like working for a faculty, it was an accident home, we make our own plan.

Researcher:

What risk are normally associated with when it comes to in terms of budget compliance ?

Respondent:

Budget compliance has been a problem, because there were codes which were not understood from a faculty level. eg. The lecturers were using the budget for the school instead of using student resale account so it meant that the institution did not exceed what it budgeted for. But the risk is for faculty to transfer one entity to the other. That to me is mismanagement of funds because if we knew what we were doing would know to bring this X amount. And also what was shown to us this year was that there was huge amounts which was not used. It was returned back to the caucus and to me that is the same as overspending, under spending is a risk because you put money out there that you are not going to use.

Researcher:

In terms of third stream income, are there any risks associated with that to reach target and if there are, do you have measures in place ?

Researcher:

I think the CFO will know better about that one but I know that in management meeting the issue of us still have to do more in terms of the third stream income.

Respondent:

Risk associated with institution as first choice. First choice in terms of students' satisfaction index. What are some of the risk associated with that ?

Respondent:

What was highlighted in our strategic plan was that first choice carries two things. The administration part was a risk for us because the students were not satisfied of how we kept our records, how we follow things through but they were pleased with the academic side of things. When academics talk about curriculum renewal, if we are not talking about administrative renewal, then you are missing the point, because students don't come to university only but also come for the complete services.

Researcher:

In terms of the category of percentage rate or pass rate for students groups, are there risks associated with that?

Respondent:

I think the problem at university, especially at this university, the highest failure rate is the first semester for first year students. Because at that stage students are not properly prepared and by the time they are ready in terms of their DPs' purposes, then the semester will be coming to an end. I think the risk is not preparing students before they come to the university. The orientation that takes place is not rigorous enough to expose students to what is ahead of them.

Researcher:

Teaching and research, in terms of risk associated teaching and research are there risks associated with true put target.

Respondent:

The risk is record keeping which is part of the administrator. Because you find that academics are sitting in the class room with a class of thirty but when you look at the ITS there are about three or four students who are no registered for that day. And the other risk that we have identified is the credit overload that the when students are registered for a course like BE.d and they do far more practice then expected. In terms of financial returns, if the university is getting FETs' for BE.d, it is not going to get more because the student did 640 credits instead of 480 credits. For me that is a risk. Coming back to true put, if for instance we loose records of students that were supposed to have graduated in 2006 and the student is carrying with one module yearly, by the time they graduate, we are not meeting the true put. And other thing is, post graduate students stay in the system for too long. Eg. A Master's student that will stay in the system for five or six years. Then by the time the time there is true put, they are not worthy of FETs'. Some drop out of the course. And if it was course work, we would have had FETs' for the course work and people would delay the research component but now if people are doing research and they are taking so many years to do research, you loose FETs'.

Researcher:

Why is some students using more than the required years to do second qualification like eg. Masters, Doctorates.

Respodent:

If you look at Fort Hare and the client. Fort Hare is a total black institution and therefore taking students that are not necessarily ready to do research. So we get the worst clients. Whereas if for instance we trained a good Masters student and the risk is that, when that student wants to do a PHD, he will look at other institutions not Fort Hare. The one that will come to Fort Hare, is the one that was weak, either from Fort Hare and feels that he/she cannot go to other institutions or was weak at Wits and assumes

that Fort Hare is an alternative. The positive thing can say about that is that we have a many staff members because of the free waver and incentive and convenience that are doing their PHDs' through Fort Hare.

Researcher:

In terms of retention targets met; are there any risks around it, in terms of research, teaching.

Respondent:

There is now a tracking system I think which is at least going to give us measure of where we are in terms of retention. I also think the free waiver for Masters and PHD is another retention strategy from the university.

Researcher:

What are some of the improvements made concerning research in the university?

Respondent:

I think the training of the supervisors, one of the interventions. The incentives associated with the supervisors is one of the interventions. Hands-on approach by the supervisors themselves in doing research.

Researcher:

In terms of improving programme quality, the number of quality programme reviews, how are they reviewed in terms of meeting the statutory regulations.

Respondent:

I think the internal reviews by the programme leaders themselves, is a start, the feedback that we get from students which is administered and centralised by the teaching and learning centre. That is also another group strategy. I think most important for me are students voices in terms of how they feel about what we are doing and offering for them in terms of the curriculum.

Researcher:

How does the institution perform, the performance driven institution. What are some of the risks in teaching staff, qualifications that makes them to teach in terms of having Masters and Doctorates

Respondent:

I think the staff should be motivated that they should get their Masters and Phds', the university also in the past had more junior staff but now with the incentives and support from the government research fund that is in place that is changing by day. The risk though is that when people qualify then they leave the university. Because the university does not have in place an education strategy. You see with other institutions what happen is, when you become a Phd, then immediately they look at how they can retain you. There is no incentives for retention in terms of people that have improved their qualification and some people that they should leave the university.

Researcher:

Why are there more junior staff then?

Respondent-George:

Whilst other institutions believe in developing their own staff, this university also believes in that but where it is a risk is where the people have reached the bench mark of other institutions than they don't pay those staff members. Eg. I have a colleague who has a Phd, for the last 10 years she is still getting the same salary and she is a lecturer and not even a senior lecturer. I cannot say the reason why some staff members leave but it is a risk. Once they want to improve the face of the university, if it is not accompanied by remuneration, it will not succeed.

Researcher:

In terms of staff turnover and the level of the employees satisfaction, how does it affect the institution's as performance?

Transcript B

Interview with Respondent 2 (Lin)

Researcher:

In relation to higher education and your portfolio in this institution, how is risk defined in this university.

Respondent-Lin

My understanding is we would qualify risk as all those issues that have a negative impact in the quality of our education and also a negative impact on our viability of our education and our offerings and sustainability of our institution as an academic as well as an economic entity.

Researcher:

As part of the management are there specific risk which you have identified in the institution.

Researcher-Lin:

The location of the university especially the Alice campus, poses a risk in that we battle to attract and sustain staff. That is one key risk primarily because the town itself is a small town and for some time it has not been well developed. Staff will come in and have children battling to find schools for their children in the locality. And therefore a risk that impacts on the university is attracting and sustaining people. People would come to the university but when they realise they battle to have schools for their children and overall welfare in the Alice community that poses risk. So there tends to be a preference now with the incorporation of the East London campus. The East London is attractive for a start and they would prefer to be located in East London when they come. So the university should look at ways how to attract and retain staff for the Alice campus as well. So that is one risk and another risk I would like to include is student wellness. We draw our students from mostly economically disadvantage

environment and therefore the fees that the university charges comparatively speaking are on the lower end of the scale compared to other universities. And the result thereof is that the hostels are not well equipped and as much as there are renovations taking place but you find that students have to do with mere basics. And that alone means our students carry on but they can do better if their environment around the residences were better and we have limitations, the number of residences we have. We have a sizeable number of students studying as that is also not a good thing because it becomes an academic risk for them. They have to travel into town, find accommodation in town and back. So evening classes and using the library to the best poses a challenge to those students who are respondents.

Those are some of the challenges. East London campus also has challenges around residences because when Rhodes university was running the East London campus, it was not designed to be a residential campus now Fort Hare has taken it over because of the change in the landscape in higher education. And we are providing accommodation for students so risk for the university is that of being over charged and exploited by people who sees this as a business opportunity for themselves. That becomes another risk for the students. I suppose in the class room there are risks as well. We do not take the cream of the matriculants there are. We do try to get the best students but also only have an access. The university is committed in creating an access for those students who otherwise would fall out of our university system and that is partly being responsive to national prescripts than national policies that the universities should be accessible to students. So those students should come through the SDE route. That is the discretionary exemption and then they are afforded opportunities for development. However a foundation programme now have been developed and those students are supported through the foundation programmes, it therefore the true put for us instead of having degrees which takes three years already we having an extended curriculum and if students do well in the foundation programmes they will take about four years or so. Now already it means

that the income that we will be generating because the funding formula uses the output and they look at the graduation of the students rather than how many students we have taken in. So it means in the years we are having those students then we are not generating as much income as we would. So are some of the risks that come to mind. There are staffing issues I know, I have seen in some reports where there are problems of under-staffing, where colleagues feel that they are carrying on huge numbers of students and that doesn't give them enough space to do their own academic development, their research and publish as they ought to as academics. So in that way funding is limited because people get funding for publishing and then the university will get a portion and the individual would get a portion. So those are some of the risks that the university would need to look at.

Researcher-Lin:

What are some of the measures the university took to address those risks that you have mentioned.

Respondent-Lin:

I am aware of a planning session that I was involved in, however the university's management consists of an extended executive management and executive management. I am a member of the extended executive management. So key decisions are taken within the executive management of the university which consists of the deans, registrar, deputy registrar, vice chancellor, human resource, director and the chief financial officer. So that is where the key decisions will be taken. The extended management committee, that is where we come in and we share and we discuss. I was part of that team where we look at an analysis that was done by a consultant that was appointed to come in and do a risk management assessment for the university. So there are reports on that.

Researcher:

What it means is that you have an external unit that assess the university?

Respondent:

It is not a standing unit. For this particular risk exercise the university had appointed an external consultant to do the risk analysis for the university. And that as members of the university management we came together to try and priorities given that this is the list of risk that are there in the university which ones do we think we need to look at immediately and I know that the teaching and learning was one of them and improving the laboratories, the auditoriums, allocation of resources and the library was prioritised, because it was felt that those are the core business of the university. So that is how the university had tried to look into those and I know in the budgeting subsequently that followed the finance official would therefore top-slice and say that this year we are prioritising the library and therefore so much would go into the library. And then we would say that this year we are prioritising quality management systems of the university and then this much would go into quality management systems of the university. Hence you see some appointments now in the quality assurance unit because it has been very big because that is an area that needs to be prioritised and we re-enforce into those systems by having more people coming in. So that is how the university has been managing this and then the different managers would then report progress on where those issues are and then finally those reports would be Tabled at senate so that the rest of the university knows exactly what is happening and then as different managers we also write reports which become part of the deputy chancellor's report to council because council is the body oversees all this.

Researcher:

So in terms of measures taken by the institution it seems as if there are bodies seem to oversee that but sometimes you also appoint external consultants. Does the university have a body that seem to oversee risk management.

Respondent:

In my knowledge there is not a dedicated body that only looks at risk but what I do know is that in different committees when for instance you looking at quality assurance which is what I am familiar with. The different committees in their terms of reference are supposed to be looking at those areas that are risk areas in as far as quality management of whether it is support services or whether it is academic issues, that is in their terms of reference. Then in their reports to the committees that deal with quality they would flag what areas are areas of risk and what they are doing about it and then subsequently they will follow up to say that this is where we are in as far as this is concerned. I can give you some examples, eg. in support services it was identified that our registration processes leave much to be desired, they also identified another area in support services about the validity of the data in our ITS system. Having identified those steps that we have taken was that they had an audit of the registration process and they also have audit of the data.

They appointed an outsider to come in to compile that. However, there was screening of the people on the system to be able to look into the system and be able to see what is there. For me it looks like it is two-count, whereas you do get someone external to actually start the kick-off by doing the analysis then the next step that follows is the training of colleagues to be able to sustain and move with the system itself. Some of those things had already been looked at in the support services. Another risk that he identified was space for our university archives. So now in the university plans they are looking at bigger space for archives. That is how risk tends to be managed. The quality assurance committees when looking at risk we have a standing item that gives us an analysis of the pass rates. So you do get bi-annually an analysis of the pass rate after the June exams an after the end of the year. It indicates how the students performed and which modules seem to be a problem or modules which are under pressure, the performance needs to be interrogated as to how students are performing the way they are performing. So that is a standing item and on the basis of what comes out of that then the dean would plan and say that this is what I need to manage, what is emanating as a risk.

And then those reports are then consolidated and Tabled at senate and then senate would know what is happening and council would get informed. So that is how it happens and also with the reviews as well because we do have a policy of self evaluation and from that self evaluation of the departments then areas of risk will come out and areas of strength and then an improvement would be development thereafter.

Researcher:

Do you have one classical example of that ?

Respondent:

If we take for example the registrar's office, that was the unit that when the quality assurance regime became a serious issue within the university because the unit was opened in 2002, and then we got the instruments going, I was not there because that predates my time, I only started here in 2004. The first thing I did was to develop some instruments for self evaluation and the registrar's unit was the first unit that volunteered. In her unit what came out was issues that impacted that impacted on the organogram. They need to have specialised offices like where you would have government offices which is going to look at policies of the university, any policy gaps, look at when policies are due to be reviewed that. That office was set up, that office has been populated and we have a person operating in that capacity.

That is not just the one post, there are a number of other areas that we identified because of the self evaluation. Even the area of document management within the office, the area of registration within the office, the audits which are coming out or audits that have been completed are primarily because of the initial self evaluation that took place. So colleagues do get their hands and arms strengthened when they have gone through the self evaluation to say that this is what has been done and on the basis of that this is what we need to improve our performance. The same with the library, the library went through that and through the bench marking that they did when they did the self evaluation. They were

able to say that this is where we are not performing very well. And on the basis of that they managed to work with the resources in the library and to improve on their offering. And further, one programme that was reviewed externally, in fact the criterion that works with the library that is one area where it was found that we meet minimum standard and primary because of the internal processes they have gone through. So there feedback even if it is not as much as we want it to be, I must say. Funds allowing, we can still do better but there is a sensitivity in that issues that have been raised must be attended to but management would say there are financial constraints.

Researcher:

In terms of the financial constraints what are some of the risks the university faces especially when it comes to students debt recovery.

Respondent:

Yes that has been an issue for some time. But the reports that we have been receiving from the chief financial officer is that the debt recollection has improved drastically. I reckon some students still owe the university money but comparatively speaking the recovery of the debt has improved. So I reckon that is still a risk but it is being managed judging from the reports that we had.

Researcher:

Supposing the quality assurance unit plays the role of your own appraisal they learnt from. you some time back, health check, suppose quality assurance does that for the university. Does it include a job when it comes to student recovery.

Respondent:

We don't do anything about the financial recovery that is done by the financial officer. But what we have done in the unit, we have developed a tracking

system, a student tracking system and primarily the purpose of this system is to identify a student who is at risk, we try to identify students who are at academic risk. However, it has been argued during the process of the development of the system that students who are at academic risk is not just because they are academically weak students. At times the risk comes when they are not able to pay their fees and therefore within the system it has been built into the system to be able to flag those students who also have financial problems. And the idea and argument was that within the faculty there should be person appointed that should have access to go into the system and would be able to look at those students who seem to have risk financially. The deans also, because they have contacts and they have at times, receive monies they could distribute to students then deans could take up the responsibility of identifying that. Eg. here is a good student and struggling financially and therefore funds we have received from company X or as faculty when we fund raise we would be able to say that we have this student in this particularly course and we gave money to those. So as a unit we tried to provide a system that would enable people to go into the system and identify those students who are risk. But for the system to work it depends on the data that is put into the system, so that is where we are.

Researcher:

I want us to look at issues around the university as first choice. Here I am talking of students discussions. What are the risk associated with those issues around the university being university of first choice ?

Respondent:

The unit does not deal with that but I know we have received reports from the planning committee where student satisfaction surveys have been conducted. Those are available through the intranet. From those one is able to identify a number of issues when it comes to student satisfaction and then that is how then one can understand the risk that students face in as far as Fort Hare being an institution of first choice. I know the

marketing division tries to promote and look at the university for the students being a university of first choice.

Researcher:

Under the same first choice, in terms of pass rate, for all students, what are the challenges is the university facing when it comes to university moving into the first choice position ?

Respondent:

Pass rates really differ from programme to programme and I am not sure whether I am able to generalise around that. Because we are aware of some programmes who are doing fairly well and we are aware of some programmes where there are bottle necks, are not quite doing very well in those programmes. An analysis has zoomed into which course have those bottle necks within the programmes. So the university is aware of those. The analysis have been done in management, commerce, social sciences, science and agriculture. Last time I looked it has not been done for the faculty of education. And the reason was that the education qualification has a different character that makes it difficult for the university planner to analyse and the history of the faculty also poses a problem. Because they were a faculty then they were a school, so those kind of things. Also the programmes like the Bed, you find that there are some other disciplines offered in some other faculties and then education offers the education courses. So the structure of the faculty of education programmes has been a challenge of enlightening the risk related to those. But with the other faculties risk analysis has taken place and I am trying to remember what issues were raised in those reports. But the reports are available. Also as a quality assurance unit, what we have done is, the analysis that we got from the planning unit is that according to our true put this programme is doing well and this programme is not doing well. It is not saying why it is not doing well that is why we have put up a

funding project that is funded externally by the ADQC and we are currently doing a study where we are looking at retention. We are trying to understand factors that impact on retention of students. So maybe when that report is completed we will be able to meaningfully contribute to your question and say what are the risk issues that came out of this. At the moment I can only speculate because there is a research that is taking place. Immediately when the report is finalised it can be made available to you. We are also developing a retention policy and it has been done on a participatory basis. We have asked different colleagues for input. So there is a draft policy but it must be re-worked again after the input we have received from the workshop that we had on Tuesday. There was one in Alice on Tuesday and one in East London on Wednesday. So I think that is also something that one needs to track on.

Otherwise the statistical analysis of the true put and the graphs, those are available, you get those. We got those in the quality assurance unit so you can follow up on those as well. But the risks itself, the research is currently underway. Otherwise a study that has been done by the quality assurance unit, where interviews were conducted, there are certain pointers that one needs to refine and hoping we can confirm from the research. One of the issues that I can think of immediately was the availability of staff to students, that is posed as a risk because the one sense in which the study itself was pointing to the limited way it is happening. This was linked also to where staff reside. For instance there are people who live in East London but lectures in Alice. So they come in for their lectures. They would lecture and immediately thereafter go back. So you find that students don't have much access with their lecturers and that becomes a risk because academically it does affect them. There was also general apathy in demotivation of staff, it came out in the research that we did in 2006.

Researcher:

In terms of performance rating, what is the risk facing the university in terms of staff turn-over, employee satisfaction ?

Respondent:

There are issues around that, I am picking it up from the reports that we received because as a unit we have not looked into those issues. But from the reports that maybe deans would Table, when they report on quality issues overall or talk of the passing of students as well as the work expected from academics, I would get to know because of the complaints of the workload that the quality regime is putting on staff, complaints around modules, the issues of learner guides. I will get to know about those in that context otherwise I am not directly involved with staff when it comes to that. But I get to understand that the things that we expect the staff to deliver on are taking a lot of their time and staff don't seem to be seeing much value in that. But initially in one faculty the dean said that there were lot of complaints about this but the following year the dean said he was happy they went through that process because now that the learning guide was included they were able to identify areas they needed focus in.

They also saw continuity and there was no anxiety of where if an academic was sick they would not have a clue of happening. Although there is an element of stress or being demotivated by colleagues when they are asked to comply to these prescripts, those who have gone through them are beginning to feel quite pleased that they went through them. So that is the demotivation part. I think generally there is administrative work that academics don't seem happy to take upon themselves. Well I suppose the position of the university has been that, as much as we can negotiate there is a limit to the negotiation. There are things that have to happen so that the university can manage the university and be able to say we are really providing quality. Although we acknowledge that, what actually is happens within the classroom walls we will never know. That is something outside. But at least if we are able to vouch and say, we have put in the systems, you have put in an

environment that would make the university function and I think that makes me comfortable.

Researcher:

Are there specific risks involved associated with employee satisfaction, that brings down the index?

Respondent:

Salary issues. I am not sure with the salary issues whether it is salary issues bench marked with other institutions or whether it is salary issues not being well managed within the institution and that the packages for individuals in similar positions don't seem to be the same. Maybe it is two issues when someone looks at salary issues. It is not clear yet. It could be bench marking with other institutions and people would say that we are getting less when compared with other institutions but one thing I know for sure that caused a bit of talk, row and tension was that different people in similar institutions, look at directors and you find out that their salaries vary so much and you begin to wonder what is used here as a benchmark for the salaries. For the satisfaction index that is one thing I think it will bring it down.

Researcher:

Peromme grade. You might not have not answered my questionnaire? Is perommes grade not a national benchmark?

Respondent:

From what we were old by HR when they were doing it, it is a national benchmark. HR looks at that, I am not up to speed as to the extent they have gone into the process. And I also have this nine month gap of being on leave, so what I know might not be as up to date as things are happening. So I am a bit reluctant to say that this is what prevails because I am aware of my own weaknesses and gaps in those areas.

Researcher:

In terms of staff qualifications, eg. staff with Masters, staff with Doctorates, have you experienced any problems

Respondent:

From the quality assurance unit that bit we have looked. This exercise was not followed up because deans were asked, this was linked to staff development and from our unit we were saying that given that there were staff who did not have a minimum of a Masters qualification. This poses a risk. The university therefore needs to identify those staff and prioritise their being given their opportunity and space to attain at least a minimum of a Masters qualification. Linked to that we need to have a staff development policy and also look at staff retention as ell. So that is how from the quality assurance management we have tried to address the issue of staff qualification as a risk. I am not sure how prevalent it is in as far as percentages are concerned, how much of staff do not have a Masters qualification.

This is where deans were asked to identify and report and deans have not responded. So my sense of how prevalent this condition is, I do not know but I know that with new appointments there have been an insistence of at least a minimum Masters qualification for academics who are employed within the university. But for those who have been within the system for a long time and because deans have not really said this is where we are in my faculty, this department I am not quite sure what is happening in that area. But I know definitely know that there are colleagues who do not have Masters qualification who are teaching. And what the deans are doing about it because as academic leaders that really falls in the scope of the deans. Remember that previously, to be appointed as an academic all you needed was an honours qualification. It was a general practice. It also depended on which level you were coming in. If you were coming in as a lecturer and you were going to be teaching at junior degree level, the general norm has been made one academic qualification above the programme you will be teaching. So if you are doing junior degree and honours degree than you come in as junior

lecturer or lecturer. So if you are coming in to do Masters at least you needed to have a Phd, it always depended on how what your contact entry was. But the general standard was at least you must have one qualification above. Other people came in with honours because they were going to teach junior degrees.

Researcher

From what I can make out from what you are saying is that the policy has changed now that is why there is an insistence that deans should cross check to make sure that people should at have Masters.

Respondent:

Yes, the policy has changed

Researcher:

The programmes in terms of teaching and research are there risk associated with the reviews of programmes.

Respondent:

The programmes that have been reviewed have been reviewed driven by the external national reviews. Most of those have been in education. The risk that have come out from those is staff qualification, workload distribution which was found to be problematic and very unclear as to what principals and what guides the workload distribution. That has been a risk and IT systems. I think those are the major risks I can think of immediately. Those programmes that were reviewed internally by the university they did not take the formal format of review that the external quality assurance prescribes. That also is a new thing. However the university have had programmes before and they decided that they will faze those programmes off when they had looked at the programmes as the university without the external bodies pressing on the university to do the programmes. For example we did offer an MBA as Fort Hare but the university decided that the quality of MBA was not up to scratch and they decided to close it down. It had nothing to do with the external reviews. It

was for instance economic viability of the programme because when it was started, it as funded externally by USAID. And then the entrance requirement of the students that they have put down they said anyone with an honours degree and in the end it ended up being problematic for those students because students who were coming from other sciences were not coping very well with the MBA. So those are some of the issues as well as the management of the programme itself. It relied over reliance on external part-time academics. That is a problem as well because those colleagues are not subjected to the same conditions of employment and quality assurance because I don't know for some reason there is some flexibility in managing lecturers who come and go.

Researcher:

Thank you.

APPENDIX E: APPENDIX E: ETHICAL CLEARANCE

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University of Fort Hare
Together in Excellence

Application for clearance from the University of Fort Hare's Ethics Committee

Project Title: Relevance & Applicability of Nicholas' Risk Management Business Model in Higher Education Quality Management

Principal Investigator: Anass Bayaga
Supervisor: Professor G Moyo

Date of application: 27 January 2009

Having consulted the Dean of Research, I hereby grant permission to conduct the research.

Professor J R Midgley
Deputy Vice-Chancellor
Chairperson of the interim Ethics Committee

27 January 2009

APPENDIX F (Peer Reviewed Publications from current Thesis)

Article 1

Journal Name: Romanian Statistical. Review

ISSN: 1018-046X

Author(s): Bayaga, Anass

Title: Value at Risk (VAR) With Respect To Single Risk Factor

Abstract:

The paper reports on developing a value at risk (VaR) model with respect to a single risk factor. In the process, it shows how stochastic differential equation (SDE) and its variants can be considered as special cases of the VaR framework developed. Using VaR, the main result (equation) was obtained with respect to the confidence level c of a position consisting of N of the same instruments depending solely on a single underlying risk factor S. The results of the analysis indicate that one can write down the two formulas for risk involved in both a long and short position in one and the same risk factor.

Article 2

Journal Name: Journal of Applied Quantitative Methods

ISSN: 1842-4562

Author(s): Bayaga, Anass

Title: Logistic Regression: Usage and Application in Risk Analysis

Abstract:

The objective of the article was to explore the usage of multinomial logistic regression (MLR) in risk analysis. In this regard, performing MLR on risk analysis data corrected for the non-linear nature of binary response and did address the violation of equal variance and normality assumptions. Additionally, use of maximum likelihood (-2log) estimation provided a means of working with binary response data. The relationship of independent and dependent variables was also addressed. The data used included a cohort of hundred risk analyst of a historically black South African University. In this analysis, the findings revealed that the probability of the model chi-square (17.142) was 0.005, less than the level of significance of 0.05 (i.e. $p<0.05$). Suggesting that there was a statistically significant relationship between the independent variable-risk planning (Rp) and the dependent variable-control mechanism (control mecs) ($p<0.05$). Also, there was a statistically significant relationship between key risks assigned (KSA) and time spent on risk mitigation. For each unit increase in confidence in control mecs, the odds of being in the group of survey respondents who thought institution spend too little time on Rp decreased by 74.7%. Moreover, the findings revealed that survey respondents who had less confidence in control mecs were less likely to be in the group of survey respondents who thought institution spent about the right amount of time on risk planning.

Article 3

Journal Name: Journal of Applied Quantitative Methods

ISSN: 1842-4562

Author(s): Bayaga, Anass

Title: Mathematical Risk Analysis: via Nicholas Risk Model and Bayesian Analysis

Abstract

The objective of this second part of a two-phased study was to explore the predictive power of quantitative risk analysis (QRA) method and process within Higher Education Institution (HEI). The method and process investigated the use impact analysis via Nicholas risk model and Bayesian analysis, with a sample of hundred (100) risk analysts in a historically black South African University in the greater Eastern Cape Province.

The first findings supported and confirmed previous literature (King III report, 2009: Nicholas and Steyn, 2008: Stoney, 2007: COSA, 2004) that there was a direct relationship between risk factor, its likelihood and impact, certiris paribus. The second finding in relation to either controlling the likelihood or the impact of occurrence of risk (Nicholas risk model) was that to have a brighter risk reward, it was important to control the likelihood of occurrence of risks as compared with its impact so to have a direct effect on entire University. On the Bayesian analysis, thus third finding, the impact of risk should be predicted along three aspects. These aspects included the human impact (decisions made), the property impact (students and infrastructural based) and the business impact. Lastly, the study revealed that although in most business cases, where as business cycles considerably vary depending on the industry and or the institution, this study revealed that, most impacts in HEI (University) was within the period of one academic.

The recommendation was that application of quantitative risk analysis should be related to current legislative framework that affects HEI.

Article 4

Journal Name: ISSA Information Security South Africa – IEEE

ISBN: 978-1-4244-5494-5

Author(s): Bayaga, Anass and Flowerday, Steven

Title: A Conceptual Operational Risk Model for SMEs: Impact on Organisational Information Technology

Abstract:

Building on prior research related to the impact of information technology (IT) and operational risk management (OPM) in the context of SMEs, this paper proposes there is a relationship between IT operational risk management and performances of SMEs. Specifically, a model is developed showing the relationship between IT operational risks, evaluation models, principal causes of IT failure, change management requirements, characteristic(s) of business information and lastly disorganised (chaotic) state of organisation(s) will never lead to the same results of operational risk management (ORM). Conceptual and empirical literature is explained within this model. The discussions are then used to generate research propositions that represent the models which in effect provide insight on how the variables are linked. Hence, further research can prove empirically the relationships and hence provide a contribution in the area of IT operational risk with regards to SMEs.

Article 5

Journal Name: Romanian Statistical Review

ISSN: 1018-046X

Author(s): Bayaga, Anass

Title: Quantitative Risk Analysis: Method and Process I

Abstract:

Recent and past studies (King III report, 2009: 73-75; Stoney 2007; Committee of Sponsoring Organisation-COSO, 2004, Bartell, 2003; Liebenberg and Hoyt, 2003; Reason, 2000; Markowitz 1957) lament that although, the introduction of quantifying risk to enhance degree of objectivity in finance for instance was quite parallel to its development in the manufacturing industry, it is not the same in Higher Education Institution (HEI). In this regard, the objective of the paper was to demonstrate the methods and process of Quantitative Risk Analysis (QRA) through likelihood of occurrence of risk (phase I). This paper serves as first of a two-phased study, which sampled hundred (100) risk analysts in a University in the greater Eastern Cape Province of South Africa.

The analysis of likelihood of occurrence of risk by logistic regression and percentages were conducted to investigate whether there were a significant difference or not between groups (analyst) in respect of QRA.

The Hosmer and Lemeshow test was non-significant with a chi-square (X^2 =8.181; p = 0.300), which indicated that there was a good model fit, since the data did not significantly deviate from the model. The study concluded that to derive an overall likelihood rating that indicated the probability that a potential risk may be exercised within the construct of an associated threat environment, the following governing factors must be considered: (1) threat-source motivation and capability (2) nature of the vulnerability (3) existence and effectiveness of current controls (methods and process).

Article 6

Journal Name: The Journal of International Social Research

ISSN: **1307-9581**

Author(s): Bayaga, Anass

Title: Institutional risk management: analysis of factors associated with the extent of monitoring and reporting of risk

Abstract:

The study investigated factors associated with the extent of risk monitoring and reporting. This was conducted amongst risk analyst in a black historical University in the Eastern Cape area of South Africa. Sixty-four risk analyst in different entities of the University participated 50 percent of (n = 32 out of 64) respondents in the sample had neither partially or completely implemented factor of IRM in terms of monitoring nor reporting, while 35 percent (n = 22) have not made a decision to implement IRM or have no plans to implement monitoring nor reporting of IRM. The findings of this study was conclusive on three facts: (1) the University does not have overall reporting processes designated to risk officers on risk to make required annual audit (2) the University does not have formal risk management monitoring and reporting systems- FRMMP (3) the University does not have sufficient resources in relation to risk management and its development. Although, if FRMMP and other factors implemented, could be significant and does impact on the institution risk management as a predictor ($p<0.05$), with odds ratio being 0.639, (a value <1). This indicates that the more FRMMP in the institution, the less likely, the institution is to report risk. Collectively, the results (other factors)

suggested that a high tendency of quality IRM factors correlate positively with IRM monitoring and reporting.

Article 7

Journal Name: The Journal of International Social Research

ISSN: **1307-9581**

Author(s): Bayaga, Anass and Moyo, George

Title: An Investigation into the Relevance and Applicability of University-wide Risk Awareness: Effect of Risk Policies and Procedures

Abstract:

In global educational context, adequate application of institutional-wide risk awareness (IRA) is recognised as crucial in efforts to achieve targets set in both mission and vision of respective Universities. But the situation in many African is that fewer Universities are pursuing the IRA. This study identifies one African University where, contrary to global trends in institutional-wide risk awareness is under-elevated in IRA. Using qualitative and quantitative methods, and guided by the Harvey & Green, Stoney, Higher Education Funding Council for England-HECFE and King report, the study investigated the risk awareness and the variables that impact on University-wide risk awareness. The data collection methods included interviews, questionnaire and document analysis. Significant conclusions based on the relationships between University-wide risk awareness and the risk variables emerged. The main conclusions of the

study are (1) risk awareness does correlate with institutional preparedness. The two main forms of preparedness associated with risk awareness are, firstly, understanding and documentation of risk policies and practices (2) risk treatment (action) plan was found to be an important factor to consider in creating risk awareness.

Article 8

Journal Name: The Journal of International Social Research

ISSN: **1307-9581**

Author(s): Bayaga, Anass

Title: Determinants of Institutional Objectives and Risk Identification: Relative Relationship – Case of a University

Abstract:

The objective of this study is to investigate the relationship between the determinants of institutional Objectives and institutional-wide risk identification. In this study, guided by both qualitative and quantitative methods, the researcher uses content analysis and Speraman's ranked correlation analysis to investigate relationship between determinants of institutional Objectives and institutional-wide risk identification. The researcher also controls for other determinant using partial correlation analysis. The results were in two folds. Firstly -the University under investigation does not identify and prioritise its risks to a sufficient standard- that the University's' key risks are not linked to its strategic objectives- that the University does not ensure that the awareness of the institution's key risks is cascaded downward, upward or horizontally

through out the university employees. Secondly, the findings indicated that - there was strong, positive correlation between F1 (clientele base-institutional objectives) and risk identification activity- in contrast, there was no relationship between F2 (opportunity for learning) and risk identification- meanwhile, there was evidence to suggest good agreement between F3 (sources of risk) and risk identification- finally, there was a strong, negative correlation between F4 (alumina related institutional objective) and risk identification.

Article 9

Journal Name: The Journal of International Social Research

ISSN: **1307-9581**

Author(s): Bayaga, Anass and Mtose, Xoliswa

Title: Quantitative Risk Analysis: Determining University Risk Mitigation and Control Mechanisms

Abstract:

The paper seeks to examine adequacy of risk mitigation mechanisms by using methodologies derived from quantitative risk analysis in a University context. A questionnaire and an interview schedule were administered. The researcher used risk modal responses model for the evaluation of the adequacy of risk mitigation. Furthermore, the researcher incorporated expert judgements, binomial distribution model and one way-repeated measure ANOVA into the risk mitigation analysis. The first category of findings revealed that (1) the University has no adequate control mechanisms to mitigate risk (2) the University does not take adequate account of key risks identified by key stakeholders and thirdly (3) the University's overall approach to risk management, as assessed for one-academic year is not adequate for its strategic

objectives. The second category from general perspective suggested there was a significant relationship between individual key risks been assigned to appropriate managers and risk mitigation. Moreover, there was good reason to suggest a relationship between various committees taking adequate account of key risks identified by key stakeholders and risk mitigation. Lastly the results revealed that there was enough evidence supporting a relationship between institution's overall approach to risk management, and its strategic objectives on risk mitigation.

APPENDIX G (Reviewed Publications not from current Thesis)

Article 10

Journal Name: Problems of Education in the 21st Century

ISSN: 1822-7864

Author(s): Bayaga, Anass, Mtose Xoliswa and Quan-Baffour, Kofi Poku

Title: Social influences on the studying of mathematics by Black South African learners

Abstract:

This study sought to explore how social factors influence learner's Mathematical development. The respondents were selected according to a mixed method approach, where the dominate approach was quantitative method. Results revealed that the social variables significantly predicted learners mathematics achievement. These were status of parent, duration of parental ship, parents attendance at school meetings. Other significant predictors included financial and material contributions to learners from parents.

Article 11

Journal Name: Curriculum Issues in Higher Education

ISSN:

Author(s): Bayaga, Anass and Quan-Baffour, Kofi Poku

Title: The 'African' Curriculum: Its content and relevance to Africa's Regeneration

Abstract:

The aim of the paper is to investigate, understand and advocate for an 'African' curriculum, a type of learning experiences 'brewed in an African pot' but borrows from Western education values and practices that are relevant to Africa's regeneration. The design of the paper is based on a literature review. The paper argues that for Africa to achieve a true 'rebirth' the school curriculum, its content, values and indeed the school system itself must transform to have a hall mark of Africa's true identity.

Article 12

Journal Name: The Journal of International Social Research

ISSN: **1307-9581**

Author(s): Bayaga, Anass and Lekena, Liile Leratu

Title: Application of Non-parametric Analysis Technique **A**mongst Postgraduate Education Research: A Survey of South African Universities

Abstract:

The objective of this research was to determine factors that influence application of non-parametric analysis technique. The data emanated from research done by postgraduate students over a ten year period (1995- 2004) and archived by the project in postgraduate education research (PPER). A Survey of three South African universities was conducted. The classification of researches from chosen prominent universities were made by research title, research topic, target population,

data collection method, and other diversity titles which were used to map the position of non parametric analysis. The sample in the three (3) universities included four hundred and twenty-one (421) sampled researches. The first finding indicated that the data presentation chapters of the sampled researches were all analysed using descriptive analysis without application of non-parametric technique. Thus, no sampled research applied nonparametric analysis technique. Secondly, the findings suggested that there was a relationship between research title and data analysis technique. Thirdly, there was association between research titles and target populations, which consequently influence choice of data analysis. Lastly, the dominant themes amongst the sampled researches were age, inclusive education and education.

Article 13

Journal Name: Problems of Education in the 21st Century

ISSN: 1822-7864

Author(s): Bayaga, Anass

Title: Effective Practice of Mathematics Teaching: Through the Lesson Study Model

Abstract:

In light of the lack of attention given to Lesson Study Model (LSM) in South African mathematics education, this study used methodology derived from LSM to study effective teaching of mathematics in a historically Black South African University students (50) pursuing a Postgraduate Certificate of Education (PGCE) programme in the greater Eastern Cape Province. The paper presented empirical work related to effective teaching of mathematics in order to determine major issues of importance for future research and to understand the issues in relation to

theory and application of LSM in South Africa context. The study applied a two phased sequential mixed
methods. In the first phase, analysis of MANOVA and repeated-measures ANOVA were done to investigate whether there was a significant difference or not between groups in respect of experimental and control groups. In the second phase, interviews were done in order to explore different aspects and opinions of planning via the LSM. The two main findings included (a) LSM was a better predictor of improving mathematics teaching and (b) distinct views on LSM could be identified by the mathematics teachers in the process of using LSM. One of the implications from the study was that LSM could be accepted as a turning point in developing the metacognitive skills, emphasising the reflective teaching and learning and providing internal consistency of instructional planning. Additionally, LSM provides a framework within which prospective teachers as well as teachers could model not only the way they teach, but also the way they examine and analyse their teaching.

Article 14

Journal Name: Problems of Education in the 21st Century

ISSN: 1822-7864

Author(s): Bayaga, Anass

Title: Statistics & Probability Education in South Africa:
Constraints of Learning

Abstract:

The purpose of this empirical study was to investigate the difficulties of learning statistics and probability amongst students pursuing Postgraduate Certificate of Education (PGCE) programme in University of Fort Hare in South Africa.

The approach was a mixed method, sampling 43 students, in which case a quantitative analysis (RM-ANOVA, RM-MANOVA & ANCOVA) dominated to test four propositions.

The findings revealed four conclusions: (1) students receiving deliberate instruction in how to solve problems do become better and are able to ‘think statistically’ (2) there was good reason to suggest that students’ level of specific mathematics skills impact on their statistical ability (3) in contrast, there was not enough supporting evidence to suggest that students’ intuitive notions of probability does get stronger with age and lastly (4) efficacy of computers in guiding design of instruction is an important component of statistical learning.

Most important implication of the study was that the use of strategies to improve students’ rational number concepts and ratio/proportion reasoning assists to recognise and confront common errors in students' statistical and probability thinking.